ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

Vol. 8. No. 8. WEEKLY. NEW YORK, SATURDAY, APRIL 24, 1886. $3 per annum. Single Copies, 10 Cents.

Copyright, 1886, by ELECTRICAL REVIEW PUBLISHING COMPANY, 33 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

A Hanger for Outside Lamps.

A new hanger for arc lamps, invented by C. C. Haskins, of Chicago, is favorably received by the electric lighting public, a cut of which appears on this page. This hanger is quite simple, the illustration showing anyone the method of operating it. It consists of two rods of any convenient form, the upper one of which is made fast to the building. The second rod is hinged to the upper at a point near the building where the upper rod is attached. At the outer end of the upper rod is a pulley through which the cord for raising and lowering the lower rod runs, and on this upper rod near the outer end is a catch, which, when the lower rod is raised latches on to a lug on the lower rod. A second cord attached to this catch, when pulled, releases the fastening, and allows the lower rod, to which the lamp is attached, to be let down, and inward toward the building. The wires are carried along the lower rod on insulators to a point over the lamp, and drop perpendicularly to it.

In this hanger the ungainly loop, which in addition to its objectionable appearance, is always getting electric light people into trouble by grounding the line, is dispensed with, and the rope is relieved of the weight of the lamp. The lamp when lowered for trimming is at the inside of the sidewalk, out of the way of pedestrians. The connections being all permanent, less wire is required, and the less outside wire there is on an electric-light plant the less cause there is for trouble.

Mr. C. C. Haskins, the inventor, has applied for patents, and it is his intention to furnish only the essential parts of the hanger, and permit those who purchase, to attach these to such rods as they may select.

Concerning Poles.

About the last thing that is thought of when a telegraph, telephone or electric light line is to be built is the poles, although the poles are the first thing required. The poles generally have to be shipped considerable distances and expensive delays frequently occur by neglecting to order poles in time.

Getting out telegraph poles is now an important industry, giving employment to a large number of men. Cedar poles grow in swamps, and cannot be gotten out except when the swamps are frozen or during an exceptionally dry time.

The pole trade has been dull for three years and prices have been so low that very few poles have been gotten out during the past two years, and the stock of poles in the country is now lighter than it has been at any time for the past 15 years. Poles will be very scarce before new stock can be gotten out, and prices will undoubtedly advance considerably during the next three months. Cedar telegraph poles come from Northern Michigan and Wisconsin, Michigan supplying about three-fourths of poles used in the United States.

*** The city of Detroit, Mich., is determined not to be behind in the matter of electric locomotion. Four electric railways are now being organized, the investors figuring on the growth of the city as the basis of these extensions.

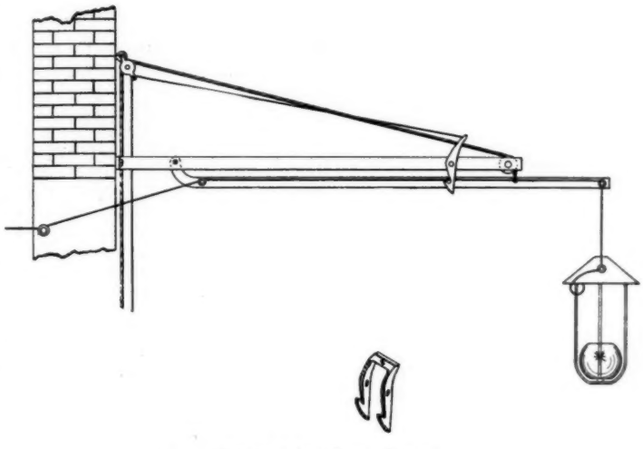
Telephone News from Nebraska.

The Nebraska Telephone Company paid its twelfth quarterly dividend of two per cent. on March 31st, and has enough left over to pay the staff's salaries for a week or two. This company has recently purchased the Nebraska City Exchange, and ordered material for a No. 12 standard gauge, hard-drawn copper wire, to be used in a line from Nebraska City to Lincoln, a distance of sixty miles, which will be finished by June 15th.

The Nebraska Company has just leased new head-quarters for ten years, on the fourth floor of Richard's new bank building, the finest offices in the city, and will move in a few weeks.

This company, in reply to the occasional statements appearing in the electrical press about the "best" or "largest proportion" exchanges in the country, has a claim or two to make in this direction. Lincoln, Neb., had May 1, 1885, according to State census, a population of 21,000 persons. On that date there were 374 paying subscribers, or one to every 56 people. It is estimated that Lincoln has at the present time 23,000 inhabitants, and the exchange numbers 410 paying subscribers, maintaining the proportion. Schuyler, Neb., has 1,900 inhabitants, possibly 2,000, and yet the telephone company has the remarkable list of 57 paying subscribers, or one to every 35 persons living in the town. Beatrice, Neb., has 6,000 inhabitants, with 116 paying subscribers—one to every 52. Kearney has 3,500 inhabitants, with 92 subscribers.

Where is the telephone company that can surpass this proportion?



HASKINS' ARC LAMP HANGER.

Burying the Wires in Chicago.

Wires are going underground in Chicago at a very rapid rate, considering that most of the work of taking them down can only be done on Sunday, when there is little traffic in the business part of the city. Dearborn street was cleared on both sides from Madison street to the river, a distance of 2,000 feet, a few days ago. All the poles have been taken down in Wabash avenue from Monroe street to the river, 2,500 feet; on the west side of Clark street, from the bridge to Madison street, 2,000 feet; on the south side of Water street, 4,000 feet; and on Michigan avenue as far as Lake street, 1,400 feet. The west side of Market street has been cleared from Van Buren street to the river, a distance of 4,000 feet, and many preparations are being made to clear Randolph and other streets. City Electrician Barrett expects to see all the wires north of Van Buren street removed within three months, and all north of Twelfth street before the season is over. The district north of Twelfth street is about one and one-third miles long and three-fifths of a mile wide, and includes the business center of Chicago. The work of burying the wires is also being carried on on the West Side. The various companies find that the wires work with equal efficiency underground as overhead. The telephone company has taken down its wires on Lake street, Michigan avenue and Fifth avenue, and is busily engaged placing the wires in its own conduits. The Dorsett Conduit Company strings the wires for electric lighting and private wires and tickers.

*** It is unofficially stated that since the removal of telephones in the city of Indianapolis the streets have taken on a much more business-like appearance. This is due to the fact that business men are compelled to run all over the city, spending half a day attending to business that was formerly completed in five minutes in their office, by use of the telephone. The shoe trade is looking up in Indiana.

*** The Mexican Telephone Company, at its annual meeting in New York last Thursday, elected directors, as follows: William Reed, J. D. Sargent, E. B. Welch, George W. French, J. H. Goodspeed and A. Dennison of Boston, and M. L. Guiraud of Mexico. Mr. Sargent was chosen president, Mr. Reed treasurer, Mr. Guiraud general manager, and Mr. H. W. Gray secretary. The only change in the board is the election of Mr. Guiraud in place of Mr. F. B. Beaumont, who retired from the presidency some months since.

A Startling Revelation.

The Pan-Electric investigation at Washington, which has for some time past been conducted by a committee of the House of Representatives, has brought out many facts of high and curious importance, but nothing, perhaps, which exceeds in public interest the contract which was signed in duplicate and exchanged between the National Improved Telephone Company and the Pan-Electrics:

This agreement, made and entered into this day at the city of Washington, in the District of Columbia, by and between the National Improved Telephone Company, a body corporate, incorporated under the laws of the State of Louisiana, party of the first part, and the Pan-Electric Telephone Company, a body corporate, incorporated under the laws of the State of Tennessee, party of the second part, witnesseth:

That whereas each of said parties is the owner respectively of certain valuable telephone inventions and improvements in respect to which there are now pending certain suits between the said parties and the American Bell Telephone Company, in the United States Court at New Orleans, in the State of Louisiana, and at Memphis, in the State of Tennessee;

And whereas the parties hereto, the said National Improved Telephone Company and the said Pan-Electric Telephone Company, propose to commence proceedings in the name of the United States against the American Bell Telephone Company, provided they can obtain the assent of the Attorney-General of the United States to do so;

Now, therefore, it is hereby stipulated and agreed by and between the parties hereto that in the further conduct of the suits now pending as aforesaid, they will render such mutual aid and assistance as may be convenient and necessary to protect and secure their common interest.

And it is further stipulated and agreed that, should they succeed in having a suit brought by or in the name of the Government, the lawyers of each party shall be entered as counsel of record in said suit, and every possible assistance shall be given by the contracting parties to carry it to a successful conclusion.

With this further express agreement and understanding; that there shall be no settlement or compromise of the same by either party in interest without a full discussion thereof by the members of both companies, and an agreement upon such terms of settlement or compromise as may seem just and fair to both.

In witness whereof the proper officers hereto attach their hands and seals this 4th day of August, A. D, 1885: Isham G. Harris, Vice-President, Pan-Electric Telephone Company, the President being absent.

The National Improved Telephone Company, of Louisiana, by W. Van Benthuysen, President.

This memorable document was executed on the 4th of August last, and it was confirmed and expanded in a supplemental agreement made three weeks later, on the 27th of August, from which the following passages are extracted:

The officers and agents of the said two companies shall co-operate in the use of all lawful means to secure the cancellation, recall, or modification of the letters patent granted to Alexander Graham Bell, and, for the purpose of accomplishing the same, *they shall obtain, if possible, the action of the Government of the United States by direct proceedings* in its own name, or at the relation of some agent or officer of one of the above-named companies, to be hereafter selected.

And it is further specially stipulated and agreed that neither of the contracting parties nor their agents nor attorneys shall use or exert any influence whatever to bring about a discontinuance or termination of said liti-

gation before final decree shall be had therein, except after full conference and mutual agreement upon the terms thereof; it being the understanding that both companies must agree to settlement, dismissal, or abandonment of the suit herein provided for.

Before these contracts the two companies had been active opponents of each other, but here we see them making common cause. The first purpose that they propose to accomplish is to get the Government of the United States to bring a suit "in its own name or at the relation of some agent or officer of one of the two companies, to be hereafter selected;" and the design of this suit is to be "the cancellation, recall, or modification" of the Bell patent.

Next they agree that after they have got the Government to engage on their side in this patent controversy, neither of them shall come to any settlement with the Bell people, "except after full conference and mutual agreement upon the terms thereof; it being the understanding that both companies shall agree to settlement, dismissal, or abandonment of the suit herein provided for."

Isn't this a very queer stipulation? It shows that the interest of the Government is nothing in this patent suit, but that it is all the mere affair of these two sets of speculators, and that they expect to control the President so far as to have the Government suit settled, dismissed, or abandoned, just as may suit their arrangements. In other words, they are to run Mr. Cleveland, Mr. Garland, Mr. Goode, Mr. Lamar, and all the other members of the Administration who have anything to do with the business, just as may suit their own plans and bargains. The President and the members of his Cabinet are only puppets that the Pan-Electrics and Mr. Van Benthuysen are to move about at their private will and pleasure.

Has not this scandal gone far enough? Have Mr. Cleveland, Mr. Bayard, Mr. Whitney, and the other gentlemen of the Administration, who are not personally implicated, no sense of the attitude in which these things place them before the public?—*N. Y. Sun.*

Electric Lighting in England.

Owing to the restrictions imposed by the act of 1882, electric lighting on any large scale is still a matter of the future in England, and the industry has not developed to any such extent as in Germany, Austria, Italy, or Belgium, and by no means as in this country. Perhaps partly from this interference with the development of a large system of distribution for electric lighting, and partly on account of the existence in England of large country houses in the possession of wealthy owners, the electrical illumination of single houses has been brought to a higher degree of perfection than domestic electric lighting in other countries. Men of wealth have constituted themselves into amateur electricians, the marvels of electricity apparently exerting a captivating influence upon their minds, and its study has been a hobby of many, says *Science.*

The pioneers of domestic lighting in England were Sir William Thomson, Sir William Armstrong, Mr. Coope, Mr. Sellon, and Mr. Charles Moseley. Sir William Thomson used a gas-engine, and worked his lamps directly from the dynamo, not only lighting his house, but also his classroom and laboratory in the University of Glasgow. Sir William Armstrong obtained his power from a waterfalls in his ground. Mr. Coope used a steam engine; and Mr. Sellon and Mr. Moseley relied on secondary batteries, obtaining their power from gas-engines.

The good examples thus set have been followed by many, and at present a great many private houses in all parts of the country are thoroughly and efficiently lighted. In fact, electric lighting is becoming a fashion, and in the opinion of Mr. Preece, as expressed at a recent meeting of the London Society of Arts, "the only fear of its ultimate general success is its falling into the hands of the inexperienced and ignorant."

Steam, gas, and water power have been satisfactorily used as agents for the production of power. Petroleum has not as yet had a trial in England, and wind is too uncertain to be relied on. Mr. Preece believes that a simple effective steam domestic motor has not as yet been introduced; but in this opinion he was criticised by Mr. Crompton, of the Society of Arts, who affirms that there are several English engines which could be worked by a gardener or butler as satisfactorily as a gas-engine. But most of the high-speed engines require more technical skill than is usually to be found among the domestics of an ordinary household. On this account the council of the Society of Arts has under consideration a plan of offering prizes for the best engines designed to fill the special purposes of providing power for electric lighting. The competition will probably be extended to all classes of engines—steam, gas, petroleum, or what not.

At present the gas-engines seem best adapted to supply the need. According to the statement of Mr. Preece, 25 cubic feet of gas will give us one horse-power, or eight 20 candle-power glow-lamps, or 160 candle-power all told; but five 5-feet burners will give only 75 candles when burned in air with ordinary burners. Gas-engines, moreover, are within the intelligence of butlers, gardeners, and coachmen; they are always ready for work, they attain their maximum efficiency at once, and they can be stopped in a moment.

In England the opportunities of using water-power are few and far between. The power of the tide or that of a flow of the river is very small when utilized within the limits of ordinary people. The whole flow of the Thames through London bridge would maintain only 800 lamps. In Scotland, however, the case is somewhat different, There several persons have utilized the water stored up in lakes. Many wonder why the wind is never used; but, apart from its uncertainty and unreliability, there is the fact that the power developed by the best windmills is, on the average, but very small.

After referring to the sources of power, Mr. Preece turned his attention to the dynamo, and claimed that science, since the expiration of the Gramme patent, has converted a crude instrument into the most powerful converter of energy that exists. The forms of dynamo, he said, are being whittled down to two or three recognized shapes; but "as long as the spirit of rivalry is stirred up by competition and emulation, so long shall we have some manufacturer who will make a change for the sake of a change, and who will advertise his wares as the best in the world." Mr. Preece holds that little remains to be desired in the quality or price of dynamos, and that a well-constructed dynamo, kept clean and well lubricated, never overworked, should last a lifetime without much attention except to the brushes and commutator.

It is by means of the secondary battery that regularity and uniformity of current are maintained in isolated installations; and it supplies a reserve of force that renders one free from accident to engine or dynamo. Its early failures disappointed many; but Mr. Preece hopes that it has 'sown its wild oats,' and that it has become a mature, sober, practical instrument. Sir William Thomson writes, "My cells have worked to perfection. It is the greatest possible comfort to us in the house to have the light with satisfactorily equal brilliancy at all hours of the night and day, and every day in the week. I have now cut off the gas at the meter, so that there is absolutely none used in the house. I have no oil-lamps, and have not used so much as a single quarter of a candle within the last three months, and have the electric light in every part of the house where light can possibly be wanted by night or by day." Mr. Preece now uses the secondary batteries, not, as formerly, as regulators to his engine, but for the storage of electricity, charging them during the day, and discharging them through the lamps at night. He maintains that the durability of his cells is most satisfactory, and that he can see no reason why they should not last ten years at least.

Of the lamps, Mr. Preece could not chronicle so great progress as that of dynamos and secondary batteries, and he held that a good standard glow-lamp has not yet been devised. He would prefer a 10 candle lamp, working under a pressure of 50 volts, and requiring half an ampere: that would mean the absorption of 25 watts, or two-and-a-half watts per candle. The life of such a lamp would not be very great; but, if it were cheap enough, one would not mind frequent renewals. Makers of lamps seem to consider that there is great credit in securing long life; but this may be unfortunate, considering the deterioration of glow-lamps with age, owing to the wasting away of the carbon and its deposition on the glass-globe. Mr. Preece would have a lamp such that we could afford to give it a "short and merry life."

There is felt in England, on account of the small development in the industry, a difficulty in obtaining experienced workmen; and in some cases it has been necessary to send nearly the length of the island for men to put in the wires and machinery.

Mr. Preece's estimation of the cost is just twice that of gas; but this, whether too high or too low, seems to be in doubt, and it is certain that the cost is largely dependent upon the extent to which the light shall be used. Considerable impatience is felt at the restrictions imposed by the act of 1882, and the council of the Society of Arts is taking an active part in supporting the measure now before the House of Lords, intending to extend the facilities for introducing electric lighting. This act is understood to be under the direct supervision of Lord Rayleigh.

A Doubtful Recommendation.

The deliberations of the recent Electric Light Convention, held in Baltimore, were conducted in a room brilliantly illuminated by fifty-cent water-gas.—*The Progressive Age* (water-gas journal).

There was but a single objectionable feature in connecti n with the Baltimore electric light meeting, and the above paragraph gives a sufficient reason for alluding to it. The hall required artificial illumination, owing partly to the cloudy weather which prevailed during the entire session. Open complaints were made upon the floor regarding the impurity of the air, and it was certainly worse than anything of the kind we had ever experienced. The brilliancy of the illumination was not so vivid as the imagination of the writer of the above, who obviously refers to it as a victory for fifty-cent water-gas. In order to produce sufficient light for the satisfactory transaction of business, it was necessary to light so many jets that it is probable that a much larger proportion of the air was vitiated by the burning gas than by the audience, which at no time exceeded one hundred persons. We are yet in the dark as regards the cost of this illuminant. It was certainly dear at any price. If sold to customers at fifty cents per thousand feet, it should be used only for driving a gas engine with which to produce an incandescent electric light. If fifty cents is the cost of it to the company, we should be pleased to learn the price at which it is sold to the Carrollton Hotel, for instance. It is not the intention of this journal to question the methods practised by people outside of the electrical field, but in this case it appears to be desirable that the exact facts should be stated regarding the virtues of fifty-cent water-gas.—*The Electrician and Electrical Engineer.*

Gas Engine and Dynamo.

To meet the requirements of electric lighting on a small scale, Messrs. Crossley Bros., Limited, of Manchester, have brought out a small plant consisting of a vertical gas engine of five man-power, combined with dynamo, which is arranged to be driven by friction. The engine is of the vertical type, which the firm has been making for some time past, and is practically identical with the better-known horizontal pattern, with the exception of such modifications as are required by the change of form. The slide works across the side of the combustion chamber, instead of at the end, while the side shaft is driven by a pair of screw wheels. Running at 200 revolutions per minute, the engine gives 1.3 indicated horse-power and .98 brake horse-power; at 250 revolutions it gives 1.15 brake horse-power. When running light the indicated horse-power is .3. The piston measures 4½ in. in diameter, and has a stroke of 6 in.

The dynamo is of the Jones pattern. It runs at 2,000 revolutions per minute, and will feed from six to eight lamps of 20 candle-power each. It is driven by a friction pulley which runs in contact with the fly-wheel of the engine. The requisite pressure between the two is obtained by the device of pivotting the dynamo to a bracket on the engine frame, and drawing down the end of it bearing the commutator by means of a screw which tightens a strong helical spring. This method of driving recalls the frictional gear which we illustrated on page 405 of our thirty-sixth volume, and which was designed by Mr. J. S. Raworth for driving the electric light on board the S.S. Aurania. In that case, however, the strain which gave the grip between the pulleys was not transmitted through the bearings of the dynamo or engine.

The small plant we are describing is exceedingly compact and handy, and should find considerable favor with those who want to try the electric light at home. Although the dynamo will only feed eight to ten lamps, it must be remembered that these need not always be the same lamps, for the current may be switched from room to room, as the needs of the household require it. The dining-room, drawing-room and smoke-room may all be lighted in turn, and thus the wants of a fairly large house be met.—*London Engineering.*

Copper's Opportunities.

The low price at which copper has been sold the past year, from 2½ to nine cents pound below the average of the previous ten years, while the consumption has more than doubled, suggests what are the possibilities in low prices. That this should be accomplished with but a few, comparatively, of the copper mines working, indicates that the best-favored plants for market facilities and machinery control the situation. That the future is likely to bring still lower prices is questioned, and yet capital is already secured to re-equip some prolific Montana properties, and thus increase the supply.

The great consumers of copper are, and are to be, the electric companies, and the nearer this invention can be brought to the service of the common people the greater will be its needs for inexpensive equipment. This season of low prices has led copper into the place that tin and galvanized iron have monopolized, and the economy of its adoption in the line of wear will make it more than ever a necessity, so that in this popular familiarity with its value lies the great snag the boomers will strike as they connive to enhance the price. It is not forgotten that while copper now sells at from 10¼ to 10½ cents a pound, it is protected by a duty of five cents a pound, and that the very concerns selling to Boston at the above current figures freight their surplus 3,000 miles and sell it in London two to six cents a pound less than their home buyers secure it.

There is a use for copper that we must shortly enter upon that will more than double its present consumption. It applies to the needs of steam users. The introduction of copper tubing in boilers, especially in the alkaline sections of the West, should begin at once, but only the present high cost of copper prevents it. Therefore, it is suggested that as we consumed 84,000,000 lbs. of copper in the United States last year, and exported 86,000,000, cutting down our duty three cents a pound would bring us nearer to the basis of the London market, set American copper at eight cents a pound, and enable us to consume here more than half the stock now sent abroad. This, in effect, while saving freights and commissions, would be a profitable thing to the mines and a great boon to the public.

Those who claim to know say that copper can be mined profitably at five cents a pound; but this we do know, that those interested

told the same story of disaster to the business when copper sold at twenty-five cents that they did when it sold at less than eleven cents; and while they claim that Chili cannot work her copper mines and take less than eighteen cents a pound, the fact is that she has sold her copper constantly for export throughout the year for about half that value. It is probably well known that the Australian Government has an agent in the United States arranging for a cable to connect these Polynesian isles with our continent, and, were it possible to buy the copper here as cheaply as it can be had in London, we are assured that the business of cable-making would become a leading Yankee industry, and our own enterprise give Australia the lines she needs.

Our imports of copper last year were only 574,514 lbs., not one third of one per cent. of the supply, which supply aggregated 171,537,121 lbs., so that there is some evidence that an equalization of the tariff which the Administration thinks so necessary might be attempted in copper, securing probably the greatest good to the greatest number.—*Manufacturers' Gazette.*

Gutta Percha.

The extraordinary progress that has been made in electrical science within the last few years, and the consequent large consumption of gutta percha as an insulating material, has naturally caused apprehension lest the supply, owing to the great demand for it, and to the carelessness of the natives who gather it in the forests of India, shall soon give out. This has recently led to much investigation concerning the nature of the product yielded by trees of other genera (such as *Mimusops, Payena, Siderocarpus* and *Bassia*) belonging to the same natural order (sapotaceæ) as the percha tree (*Isonandra Gutta*). Mr. Pierre, in No. 46 (1885) of the *Bulletin de la Societe Linneenne*, of Paris, has given a long list of the sapotaceæ which grow in Annam, and which yield a juice that might, when concrete, serve as a substitute for gutta percha; but the trouble seems to be either that the trees grow too isolatedly or that their places of growth are too inaccessible. Mr. Edward Heckel, in a note presented to the French Academy of Sciences on the 11th of May last, made known to that body the possibility of obtaining a coagulable latex, similar to that yielded by the *Isonandra Gutta*, from the karite tree, *Bassia Parkii;* and in another note to the academy on the 28d of November, he gives the results of an examination made by himself and F. Schlagdenhaufen of the physical properties of the new product, and of its chemical composition as compared with that of gutta percha. From these researches, it appears that the two products are approximately identical. The gutta from the *Bassia* kneads in warm water with the same facility as typical specimens of commercial gutta percha, and moulds made with it are in no wise inferior to those prepared from the best quality of the last-named material. The future of the new gutta for industrial purposes would therefore appear to be certain. The karite tree is very abundant in Africa, and is distributed throughout the entire basin of the Nile—a portion of the country which has hitherto been unproductive, but which now offers a source of wealth that it needs but willing hands to develop. The *Bassia* has hitherto been known only from a fatty matter of the consistency of tallow yielded by its seeds. This product, called karite butter, is used by the natives of Africa for cooking purposes, for filling their rude lamps, for making soap, for healing wounds, and as a pomatum for the hair.

* * The greatest number of inventions on any one subject in 1885 are those relating to electricity, the number last year being 1,358, or 5.78 per cent. of the whole number, which was 23,330. The number of the last patent issued in 1885 was 333,493; of these about 265,672 are now in force (perhaps a few more than that number), which is about the number that was granted in the last seventeen years up to the first of last January.

Tapping Wires.

Four bench warrants were issued last Friday by Judge Van Wagoner, of the St. Louis Court, for the arrest of Martin Irons, A. C. Coughlan, George M. Jackson and S. W. Nichols, indicted for tampering with telegraph wires. Martin Irons is the Master Workman of Assembly No. 101; A. C. Coughlin holds the same place in Assembly No. 117; George M. Jackson is a politician and a Knight of Labor, and S. W. Nichols is an expert telegraph operator and a Knight. The indictments are the result of the Grand Jury's investigation into the recent wire-tapping conspiracy, in which the city police showed that the railroad company had attempted to lure the Knights into the commission of a felony. Among the witnesses before the Grand Jury were Frank P. McKeighan, the operator who is alleged to have been instructed by the company to induce the Knights to tap the wire; E H. Brown, manager of the Western Union; L. L. Richmond, an officer of the Knights of Labor; M. F. McDonald, assistant State attorney and an attorney for the railroad company, and Detective Thomas Furlong, of the Gould system.

The story developed by the testimony runs like this: Frank P. McKeighan, a telegraph operator employed by the Western Union, and a number of the Knights of Labor, were intimate with L. L. Richmond, a prominent Knight and a wholesale dealer in sewing machines, who introduced McKeighan to Irons and Coughlin. Learning that McKeighan was a telegraph operator, the subject of dispatches came up, and Irons and Coughlin are reported to have asked if it wasn't possible to tap the wire connecting the Western Union office with the Missouri Pacific headquarters. Irons said he had already tapped a wire at Marshall, and had received considerable information. McKeighan replied that the plan was feasible, and was instructed to find the wire and the Knights would furnish a man to do the work. McKeighan found that the wire was in a cable, and reported to Irons and Coughlan that it would take an expert to do the job properly. Coughlan said he had a man, and introduced McKeighan to S. W. Nichols, a telegraph operator who had come from Nevada, Mo., by order of the Knights. McKeighan then reported the scheme to General Manager Brown, of the Western Union, and was instructed to go ahead and report progress. McKeighan next informed Irons that the Missouri Pacific had requested the Western Union to make a loop from the main office to a certain drug store, so that Mr. Hoxie could receive night messages direct, and in his estimation the loop would offer greater inducements to tap than the cable. He was instructed to find the wire, and did so, tracing it from the office to the drug store, which is but a few doors from Mr. Hoxie's house.

McKeighan was about this time shown a telegram by Irons which he said had been intercepted along the Missouri Pacific. The operator took a copy of the telegram and submitted it to Manager Brown. The latter took the telegram, and calling on ex-Judge Portis, general solicitor for the Gould system, asked the co-operation of the railroad company in discovering how the dispatch was intercepted. He then told Judge Portis of the attempt about to be made on the wires here, and Judge Portis immediately summoned his Detectives Furlong and McDonald. It was decided that McKeighan should be instructed to go ahead, and he accordingly told Irons and Coughlan that he had found the wire. Jackson and Nichols next reconnoitred the route and selected the house at No. 2,337 Market street as the place to make another loop. McKeighan and Jackson then visited a number of stores and inspected telegraph instruments, and an outfit consisting of wires, instruments, etc., was purchased. A room was rented in the third story by Jackson, and Friday night, March 26, was set for the accomplishment of the work. Meanwhile Brown had reported operations to the Missouri Pacific detectives and it was decided to surround the house that night by a posse and arrest the men in the act. The signal for the raid was to be a lamp burning brightly in the window of the third story. Nichols climbed the pole and put an insulator up and attached a wire from the window to the insulator, but when it came to cutting the other wire and making the loop his nerve failed and he came down. McKeighan then went up and attempted to cut the wire, but a recent storm had drawn it so taut that he feared he could not hold it after it was cut. He came down and advised that the job be postponed for a few nights. It was so agreed, and Jackson and Nichols went away, while McKeighan went up to the room. At this point a coincidence spoiled everything. Mrs. Smith, who occupied the second story front, left a lamp in her window, and in a minute a squad of detectives burst into the room, frightening her almost to death. They ran upstairs and found no one but McKeighan. The latter then held a consultation with Detective Furlong and Attorney McDonald, who were with the detectives, and was instructed to go ahead again. So he did not report the raid to the Knights. While this second scheme was advancing the city detectives arrested McKeighan, and he was taken before the chief and then made the confession already published.

McKeighan stated before the Grand Jury that he was first approached by the Knights and the reason he said he was employed by the Missouri Pacific was to protect Manager Brown, who was acting as a sort of middle man between the detectives and himself. L. L. Richmond gave his testimony with reluctance, but said that he introduced McKeighan to Jackson as stated. The other witnesses, including Mr. Brown, corroborated the foregoing.

When Irons, Coughlan and Jackson heard of the warrants they had a consultation with their attorney, and by an arrangement with the Circuit Attorney it was decided that the trio should appear in the criminal court in the morning and furnish bonds for their appearance. Nichols left the city two weeks ago and cannot be found. The Knights are indignant at the action of the Grand Jury, who, they assert, were influenced by Assistant Circuit Attorney McDonald acting as attorney for Gould. Irons and Coughlan say they have no fears of the result, and deny ever having entered into a conspiracy with anyone to tap wires. The offence is a felony.

Quick Work.

The Mexico (Mo.) Electric Light Company, owned by Mr. J. F. Llewellyn, was burned out at midnight on the 8th inst. Mr. Llewellyn immediately ordered a new outfit from the Schuyler Company, which was shipped on the 9th, and will be running within a few days.

Introduction of Railways.

The following are the dates of the introduction of railways in the various countries from 1825 to 1860:

England	September 27, 1825
Austria	September 30, 1828
France	October 1, 1828
United States	December 28, 1829
Belgium	May 3, 1835
Germany	December 7, 1835
Island of Cuba	In the year 1837
Russia	April 4, 1838
Italy	September, 1839
Switzerland	July 15, 1844
Jamaica	November 21, 1845
Spain	October 24, 1848
Canada	May, 1850
Mexico	In the year 1850
Peru	In the year 1850
Sweden	In the year 1851
Chili	January, 1852
East Indies	April 18, 1853
Norway	July, 1853
Portugal	In the year 1854
Brazil	April 30, 1854
Victoria	September 14, 1854
Colombia	January 28, 1855
New South Wales	September 25, 1855
Egypt	January, 1856
Middle Australia	April 21, 1856
Natal	June 26, 1860
Turkey	October 4, 1860

The Volcanoes of Oregon.

We have little doubt that the "smoke" which rose from Mount Hood on Saturday, was, as suggested in the *Sunday Oregonian*, a consequence of evaporation caused by unusual conditions. It bore precisely the appearance of a "vapor cloud," while the fact of its being unusual ought not to occasion great wonder in a country where the unusual thing is, if we may be allowed to juggle with words, a thing quite usual. That there was no repetition of the phenomenon yesterday is a circumstances favorable to the theory that it was external, for if it had been genuine volcanic discharge, it is much more than likely that the period of activity would have extended over more than a few hours. There are many, however, who believe that the cloud was either smoke or steam, in fact, and that it came from the depths of the mountain. It is a well-known fact that there is a large crater near the summit on the western slope, a remnant, doubtless, of that "hole in the ground" of which we have heard. Many who have climbed the mountain, report that sulphurous gases issue constantly from this crater, poisoning the air to a degree which often makes respiration painful and difficult.

While we do not believe that the cloud seen on Saturday was really smoke, still it may be supposed very reasonably that it was such. Mr. S. A. Clarke, the well-known writer of pioneer records, said in a recent article that twice during a third of a century he has seen dense black smoke pour forth from the crater, and Professor Powell, formerly State Superintendent of Public Instruction, reports that at the time of his visit, some years back, the crater was discharging sulphurous heat. It is well known that Mt. St. Helens, the comparatively near neighbor of Hood, is a volcano more or less disposed to activity. It was climbed in 1875 by Hon. T. A. McBride and others, who found a crater from which a light steam with hot and sulphurous gases constantly issued.

It is within the memory of men still living when Mt. St. Helens actually "erupted." The date was November 23, 1843, and the story is told by Rev. J. L. Parrish, who, with others, witnessed the extraordinary scene from the old French Prairie Mission in Marion County, about seventy-five miles distant from the mountain in a direct line. Attention was called first by clouds of black smoke which filled the whole northern horizon, rolling in dense volumes about the base of the mountain. Above it was of lighter color, culminating in vast white columns, which penetrated the zenith. Smoke and steam in irregular black and white wreaths were belched out in distinct puffs, and finally great masses of rock and clouds of ashes came forth. Red-hot lava poured down the mountain side into the near branches of the Cowlitz, a distance of five miles from the crater, heating the water and killing many fish. Flames issued from the crater during this eruption, and at intervals for several months. All was plainly seen by Mr. Parrish and those with him, but they heard no noise, owing of course, to the distance. After the eruption ashes fell all over the country for hundreds of miles, at The Dalles to the depth of half an inch. On the following day the mountain stood calm as usual, but not in its usual aspect. It was a jet-black pyramid.—*Portland Oregonian, March* 29.

* * The North Metropolitan Tramways Company are about to apply to Parliament for leave to use electricity as a motive power on their lines in West Ham, East Ham and Leyton.

* * Frank Boling, of Cherokee, Kan., threw himself on a feather bed that lay on the floor during a thunder storm. He neglected to draw up his legs, and his feet were touching the floor, when the lighting struck the house and played about his feet, burning them and knocking him senseless. That part of his body that was on the bed was not hurt, and a child lying by his side was uninjured. All of which may be used to show that feather beds are good places of refuge in thunder-storms.

Electrical Review.

Published at 23 Park Row.
P. O BOX 3329.

GEO. WORTHINGTON, - - - Editor
CHARLES W. PRICE, Associate "
LOREN N. DOWNS, President.
ANDREW J. DAM, - Vice-Pres't and Treas
C. C. HASKINS, GEO. A. HAMILTON, } Consulting Electricians.

SUBSCRIPTION

United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.
Great Britain and other foreign countries, $4.00, in advance. Postage paid by publisher.

ADVERTISING.

Transient, 25 cents per line, nonpareil.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all Express Money orders, P. O. orders and checks, payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Frank M. Gilley, 54 Equitable Building, Boston, Mass., is our New England representative.
Mr. C C. Haskins, 118 LaSalle Street, Chicago, Ill, will represent the REVIEW in the West
Messrs. Wm. Dawson & Sons, 121 Cannon Street, London, England, are our representatives for Great Britain.

NEW YORK, APRIL 24, 1886

CONTENTS.

	PAGE
A Hanger for Outside Lamps	1
Concerning Poles	1
Telephone News from Nebraska	1
Burying the Wires in Chicago	1
A Startling Revelation	1
Electric Lighting in England	2
A Doubtful Recommendation	2
Gas Engine and Dynamo	2
Copper's Opportunities	2
Gutta-Percha	3
Tapping Wires	3
Quick Work	3
Introduction of Railways	3
The Volcanoes of Oregon	3
Editorial Notes	4
Enforced Production of Telegrams	4
The True View of the Electric Light by the Gas Men	4
Electrical News of the West	5
Boston Electrical News	5
Telephonic News	6
Personal Recollections of the Early Days of the Telegraph	6
Telegraphic	7
Electrical and Scientific	8
If True, the Most Wonderful Discovery of the Age	8
Mr. Vail's Views on the Underground Wire Question	8
Electric Light Legislation in France	9
Strange Freaks of Lightning	9
Change of the Detroit Electrical Works	9
The Pratt Speed Indicator	9
Electric Light News	9
Electrical Patents	10

It would seem that we are to have a cable war. Our English cousins will be brought very near to us by means of the submarine cable when messages cost only six cents a word.

Mr. Charles Dutton, auditor of the Southern Bell Telephone Company, delivered an address before the New York Institute of Accountants on "Account Keeping of Telephone Companies" at the regular meeting Thursday evening, April 15. The address was pointed and strong, and made a most favorable change in the views of the majority of the listeners in regard to the legitimate telephone companies and their methods of doing business. Mr. Dutton, who is a leading member of this organization, which is composed of New York accountants occupying responsible positions, is thoroughly familiar with this department of telephone work, and his address was full of much valuable information presented in an entertaining and pleasing manner.

All the electric light companies now being organized should become members of the National Association. This move will repay every one actively connected with the electric lighting industry.

It was announced from London on Sunday last that the United Cable companies had decided to reduce the rate on commercial messages from forty to twelve cents, and on press messages from twenty to six cents per word. This reduction will be warmly welcomed by merchants and proprietors of daily newspapers.

The REVIEW is in constant receipt of inquiries concerning the best books on electrical subjects, and these inquiries are noticeably increasing in number, a very natural result of the deep interest the general public is taking in such matters. It is with a desire to accommodate the seekers after information in this field. that we have revised and enlarged our list to date, including a number of recent and valuable works, and publish in full in another column.

The Gas Commissioners of New York have renewed the yearly contracts with the United States Illuminating Company and the Brush Electric Illuminating Company at 70 cents per lamp per night, the public electric lighting of this city being divided between these two companies.

Attorney General Garland was questioned by the Congressional Committee on Monday relative to his connection with the Pan Electric Telephone Company. He said that this company was simply an undertaking by a half dozen impecunious gentlemen like himself, and his "only regret was that it had not panned out better." He saw no impropriety in his holding Pan-Electric stock, and stated that no act or word of his, since becoming Attorney-General, was calculated to increase the value of that stock. Perhaps it has "panned out" better than Mr. Garland suspects, and it is very probable that the the chief beneficiary—the Administration—would not regret if it had never received its dividend of scandal and discomfort.

Col. R. C. Clowry, President of the Central Union Telephone Company, has resigned, and the board, at its last meeting, elected Mr. Geo. L. Phillips in his stead. Mr. Phillips is thoroughly equipped by years of experience and exceptionable abilities for this position, which is peculiarly responsible at the present time, due to legislative action in the State of Indiana. No man in the business has a clearer understanding of the relations existing between the licensees and parent company, or a more generous and business-like conception of what is due the public from telephone companies consistent with their corporate rights. A year's sojourn in the mountains of Swi zerland has been enjoyed by Mr. Phillips and his family, and he now returns to electrical duties rested and invig rated, abundantly able to cope with the problems before him.

In all this telephone wrangling in Indiana the Central Union Company has been far more sinned against than sinning. They endeavored, after the law was passed, to peaceably obtain a fair hearing before the courts, and agreed to abide by the decision of these tribunals. The decisions were adverse to the company, and the law declared constitutional. The two horns of a dilemma now presented themselves: To remain and waste their substance by transacting business at a loss—or withdraw from the field. No business man would be likely to do otherwise than as the company has done. It has with drawn in the least ostentatious manner possible, and with no show of vindictiveness or uncharitableness It is simply a case where the law has driven it out, and it has gone as quietly and as peaceably as possible. The patrons of the telephone now realize what an unsatisfactory position their wise lawmakers have placed them in.

ENFORCED PRODUCTION OF TELEGRAMS.

Judge Devens, of the Supreme Court of Massachusetts, sent down a decision on Friday April 9th which will be of great importance in defining certain rights of telegraph companies relative to the disclosure of messages.

The matter was brought before the Court on the petition of James C. Davis, a justice of the peace of Massachusetts, asking for an order of the Court compelling the attendance before this Davis of Thomas Roche, Superintendent of the Western Union Telegraph Company, with certain telegrams presumed to be germane to certain suits mentioned below. The opinion of Judge Devens, giving his reasons for dismissing the petition, is quite lengthy, but, after giving reasons why such a decision has not been reached before, treats of the following points at issue:

"A bill in equity was filed on Jan. 26, 1886, in the superior court in Kansas, in the name of John W. Fletcher *vs.* the Atchison, Topeka and Santa Fe railroad *et al.*, praying for a receiver, for an injunction to restrain the paying of further dividends and for the cancellation of the illegally issued stock and for general relief. The defendants to this bill filed a general demurrer. They also filed a special answer to a motion subsequently made for a temporary injunction against dedeclaring further dividends, alleging that Fletcher was not a stockholder nor the real party in interest; that the suit was not in good faith, and was brought for stock jobbing purposes in pursuance of a conspiracy with Clarence H. Vennor and others named. The plaintiff has since withdrawn his motion for a temporary injunction and receiver and has sought to amend his bill by striking out the prayer for a preliminary injunction and receiver, to which the defendants have objected. In accordance with the laws of Kansas, depositions regarding this suit have been taken in this State by James C. Davis, a justice of the peace, who issued a subpœna to Thomas Roche, superintendent of the Western Union Telegraph Company, summoning him to testify and further 'to produce and bring with him the originals of all telegrams and copies of telegrams received in Boston, and which since Dec. 1, 1885, have passed between the cities of Detroit, Kansas City and Topeka,' between C. H. Vennor and others supposed to be parties to this suit directly or indirectly. Mr. Roche appeared and testified, but refused to produce the telegrams. The petition asks for an order of court to compel the attendance of Mr. Roche and the production of the telegrams."

Continuing, Judge Devens says: "Assuming in favor of the contention of the defendants, that it is the duty of this Court to determine whether the matter inquired of is relevant to a defence which may be maintained under the law of Kansas, that a magistrate engaged in the duty of taking depositions is to be deemed a tribunal such as is contemplated by the statute of 1883 of Massachusetts, that it was the intention of the Legislature to invest this Court with the authority to decide what is relevant to a disputed question in the State of Kansas, to make orders upon witnesses accordingly, and to enforce them summarily as in contempt of this court, should they be disobeyed, and that this power might be constitutionally enforced although it does not concern the administration of justice in any court in this State, I am still of opinion that this application should not be granted. The power granted by the statute is discretionary with the Court, and it appears that the discretion given by the statute of 1883 ought not to be exercised in favor of this application—and it would be a grave violation of private rights to issue the order for which it asks. The petition is therefore dismissed."

A resolution has been introduced in the State Senate demanding a report from the New York Electrical Subway Commission within ten days There is an evident desire to know what the Commission has decided to do.

THE TRUE VIEW OF THE ELECTRIC LIGHT BY THE GAS MEN.

The following is an extract from a letter of the superintendent of the gas company of Sandusky, Ohio, which is noteworthy from the fact that it shows what is becoming the attitude of the more intelligent gas men toward the electric light:

I consider the electric light in the long run a decided benefit to the gas company of any city, more especially where the plant is owned by the gas company and located on their own premises, as I am convinced that great economy of fuel and labor expenses is thereby gained. It has always been my opinion that gas companies should keep an assortment of goods, such as gas, electric light and fuel-gas, just as much as any other merchant keeps an assortment of his particular line of goods. Electric light has its field and will surely hold it.

How much more sensible is this than the awkward efforts and discordant tones of those gas men who endeavor to create a prejudice against the electric light by crying "danger" and "great expense," and who are every one afraid to compare the list of deaths and losses traced directly to their illuminant with the record of electricity, and who cannot satisfactorily explain to the public why the introduction of the electric light always brings a reduction of the price of gas on any other grounds than that they have been imposing on their patrons and making enormous profits out of their ignorance. In this connection it will be of interest to quote from the address of Mr. M. S. Greenough, president of the Boston Gas Light Company, before the annual meeting of the New England Association of Gas Engineers, of which body Mr. Gr enough is president. The meeting was held in Providence last February, and in delivering his annual address the president presented much that was interesting and sensible, notwithstanding the somewhat evident prejudice that so many years of identification with the gas interest naturally brought to the surface. He said:

And yet the possible competition from the incandescent electric light is worthy of attention, though not of fear. It is not and never will be, in my judgment, that which its over-enthusiastic advocates have claimed. I do not believe it to be a possible thing to deliver electricity as reliably, satisfactorily and cheaply as gas; but, on the other hand, it is useless to deny the progress which the last five years have seen. Its safety, its coolness, its entire control and its beauty are undeniable. We are not looking fairly at the facts if we do not admit that there are many places into which it is sure to find its way. It is perfectly true that its coolness rather hinders than helps ventilation, if compared with scientifically-managed gas; but we all know that gas is not often managed scientifically, and that to many people the relief from its products of combustion is immense. It is true that its coolness is sometimes a great drawback. I have heard of a party of gentlemen dining in a sumptuous hotel parlor, which was lighted by electricity, and who could not keep warm The room was high, and the air in the upper part of it kept descending slowly, like a fall of snow, and acted like a damper upon their spirits and the tops of their heads. When the gas was lighted instead of the electricity, their spirits and the temperature simultaneously rose. But with the thermometer at 90° the case might have been reversed. * * * *

I believe that the time has come at last when the science of electric lighting has been so far mastered that it has become possible for a man to predict what he can supply electricity for and yield him a profit, just as he can make a similar prediction about gas. I do not mean that this knowledge is widely disseminated; but I believe there are men who can do it. The more closely these men examine the question, however, the more are they convinced that, economically, it is no match for gas. It is a light of luxury, and, as such, has a demand; but, except under unusual circumstances, gas is much the cheaper, if the electricity is surrounded by all those precautions which are necessary to make it reliable, satisfactory and safe; and it is well known to all of us that these are terms which do not apply to the electric light as ordinarily supplied at present. I do not, therefore, believe that it is destined to materially affect the gas business.

At the same time, it is a pity to see a large customer taken away from a gas company which is not, perhaps, too prosperous; and the question may well be considered, especially by the smaller companies, of the advisability of taking this business into their own hands, and supplying their customers, not only with gas, but with electricity too, if wanted. A gas company could make money

when an electric company would fail. The office expenses of a small electric company are enough to swamp its profits, whereas the additional expense to a gas company would be a trifle. They already have the office, the clerk, the manager and, perhaps, the boiler power; they have the engineers, and they have cheap fuel. They would only have to add an electrician to their staff to put themselves in the position to go into the business on the most favorable terms. It has come to my notice that more than one gas company is awake to the advantage of this step, and I earnestly commend it to the attention of the association—especially of the officers of those smaller companies who most fear the inroads of electricity, and into whose towns it has not yet been introduced. Bear in mind most distinctly that in what I have said I have not said anything which can properly be construed into any fear of electricity.

There is a flavor in the above, suggestive of the small boy in the dark lane whistling to keep his courage up, but we pass that by, and welcome the growth of those liberal and business-like views that are given expression by this prominent and representative advocate of the interests of gas.

ELECTRICAL NEWS OF THE WEST.

There isn't anything new under the sun, is there? Here's an operator down East who has been loading up a reporter, who announces the last invention thus:

"TO KEEP BATTERY JARS CLEAN.

"Operator of fire alarm Mills, of Worcester, Mass., has adopted a plan to keep his battery jars clean which will be appreciated by all similar officials who desire clean battery rooms. The plan is to pour a small quantity of oil in the top of each jar, which prevents the salts working up and running over the edge; they always form a dirty incrustation on the outside of the jars."

Operator Mills should now re-invent that other old chestnut, "How to start a new blue vitriol battery."

Joliet, Ill., has two electric light organizations, each of which, with a central plant, rents lights to customers. One of these, the Citizens' Electric Light Company, by the way, has at its head an old resident who has held nearly every office, town, county, and city, in the gift of the people, has just sent out an invitation and menu for a grand supper at the St. Nicholas Hotel, Joliet. The bill of fare is a fine one, but the reverse of the neat little invitation bears two rather suggestive cuts. One of these is a bronze bull-dog sitting in front of his kennel, the lower half in a sombre shadow, while the upper portion is evidently lighted by electricity; and covering the other page is a full cut of one of the most recent lamps, and the legend, 'How we apples swim," surmounting it. The true inwardness of the affair is "a rather tough worm" for the average inside, but one thing is quite certain there is fun, a fight or a frolic, brewing in Joliet.

In Cleveland, O., on the 12th instant, an electric light wire broke, and the two ends falling on the sidewalk grounded the terminals. Mr. Joseph Glazier, a salesman, coming in contact with the wire was seriously if not fatally injured, and two others were also thrown down. There should be no need of this sort of thing. If the party in charge of the dynamo would at once switch off the machine when the flash shows a break, and keep it so until the trouble is remedied, there would be no lives lost, and it really seems worth while to protect life, even at the expense of light upon such a circuit during the time necessary to find and repair a break. Where the wires run under ground the danger is much less—and where they do not, some such provision as suggested should be made to cover the necessities of the case.

A stationary engineer named Spillane, of this city, now bobs up serenely with another device for telephoning between trains and railway stations. His plan as reported is as simple as it will probably be useless. "A circuit wire" rests on an insulated slab between the railway tracks. A "circuit rod," made of a strip of metal with a movable roller, makes continuous connection to all stations and all trains on the line of route. The return circuit is gained by means of the rail wheel and axle, and up through the frame work of the engineer's cab to the telephone. A wire runs through the train connecting all the cars, so that conversation can be kept up from all parts of the train to all stations on the road, and between all other trains on the line.

"Mr. Spillane thinks that the adoption of his device on trains will do away with operators at stations and by its use train robberies will be absolutely checked, for any deed of violence attempted on the train would be immediately known to the authorities, and such prompt notice would not fail in procuring the arrest of the guilty parties."

This is undoubtedly true, if it can only be arranged so that any such robbers shall have a regular signature and be obliged to use it on all occasions, just as we old telegraphers do.

There is an old story of a rat convention which resolved that a cat, which was a sort of offensive partisan, should have a bell hung round her neck. The plan was a splendid success up to the point of belling pussy; beyond that it was a failure.

The Indiana troubles are still far from a satisfactory solution. The Indianapolis Council, angered at the Central Union, has rescinded the ordinance under which the company strung and operated its wires. The company, desiring to fulfil the requirements of the case, and accommodate the citizens to the fullest possible extent under the law, opened a number of toll stations. The municipal authorities have denied the right of the company to do this. A special meeting of the Council and Board of Aldermen was called for the 16th instant. At that meeting, the judiciary committee reported a resolution directing the telephone company to remove all its poles and wires within fourteen days, and in the event they are not so removed then the Street Commissioner is directed to cut them down. This resolution passed both bodies, with but one dissenting voice in either. An attempt was made to stave off the action by showing the detrimental results which would accrue to the fire alarm system, as it would require sixty days, and the unnecessary outlay of $5,000, to replace the city's lines, which are now strung on the same poles. The temper shown by the council was vindictive and unfair in every particular, and it was evidently part of the plan to prevent the company from realizing anything by the sale of either wire or poles to any successor which might take the vacated field.

Another grab was made at the company's treasury on the same day, in the matter of taxation. The County Auditor, claiming that a discrepancy existed in the sworn value of the plant, as reported to the court in the case of the recent litigation, and the return made for assessment purposes, had stated that he should correct the tax duplicate, so that the amounts would more nearly correspond. Fearing an injunction which he had been informed would shortly issue, he quickened his movements, and increased the assessment from $16,000 to $50,000, just an hour before the temporary injunction was served.

The company's grounds for asking the injunction are that the Auditor has no right to make this increase, and that by so doing a cloud is cast upon the company's title to its property, doing it irremedial wrong and injury.

A meeting of citizens *et al* was held on the 10th to investigate the claims and advantages of the several outside telephone systems presented. The unanimity of these outside parties in condemning the Bell Company and its system is only excelled by the positiveness with which each asserts the utter and thorough worthlessness of every system presented, except—mine. This is the best in the world. Mine is the only one the Bell Company is afraid to tackle in the Supreme Court, to-day. They never have, they never will interfere with this—or words to that effect.

There is a representative of the "Fare five cents, put your nickel in the box" system, who desires to sell to the Central Union. They have not so far decided to buy—and the system will probably be offered to other parties.

The different methods of running exchange systems are represented. There is the warranty or perfect sale system, where the subscriber buys and owns his instrument. He joins the exchange as if it were a singing-school, and brings his own books, rack and pitch pipe.

Then there is the intermediate sale system, as it might be called, where each exchange owns its instruments, and leases them within its own territory.

The quit claim system is still more comprehensive, and less democratic. The State is sold, including the instruments, to a grand company, which then becomes a monopoly over a certain green, or red, or yellow blotch, such as we see on a railroad map, and the various exchanges within the State pay rentals, and sublet the instruments to subscribers.

The vacancy in the superintendent's department in the late Chas. W. Ross' district has not yet been filled. Temporarily Assistant General Superintendent Wilson will have charge of that as well as his own division.

The hurricane epidemic has struck the West and South, with fearful force. On the afternoon of the 14th instant, Texas, Missouri, Kansas, Dakota, Minnesota and Iowa were visited by more or less severe wind storms at about the same hour in the afternoon. Many of these storms were accompanied by heavy hail and rain, thunder and lightning. A marked peculiarity of the storms was the great extent of territory over which these raged at nearly the same instant. Up to Friday morning following the storms over one hundred victims had perished, and the death roll was constantly increasing. The usual freaks are recorded in the neighborhood of the severest storm. One house at Rice's Station, Benton County, Minnesota, in which a wedding party was assembled, was struck and demolished and eleven persons killed, including the bridegroom, the bride's mother and the officiating clergyman.

At Sauk Rapids, in the same county, great damage, was done. The storm struck the center of the place, and did not leave a business house standing in the main portion of the town.

It is always in order for the telegraph fraternity to wrestle with the bucket shops, and it is usually the bucket fellow who wins. One day not long since, however, the usual under dog came out on top, and had things his own way, in accordance with the adage, "Every dog has his day."

Exactly why, no one seems to know, but the gold and stock tickers dragged about fifteen minutes behind the market all morning, and the operators on private lines found it out. When the ticker said chuck-e-chuck-e-e-r-r-r-r tucke-tuck-e-tucke-tuck, which, translated, means W. U. 66 ¾, they knew it should be a different chucke-tuck which would mean 65½—and they went in on their knowledge.

The woodenware stock dealers probably lost something like $500 apiece, which was divided up among a perfect army of brass pounders. It is said to have been the only dead sure speculating done here in a month.

Col. S. G. Lynch, broker, at 144 La Salle gives the following as telephone stock values:

Chicago	$365 @ $375
Central Union	50 @ 52
Michigan	65 @ 67
Iowa Union	15 @ 18
Great Southern	25 @ 30
Great Southern, Script, 65 cents on the dollar.	
Colorado	19 @ 21
Rocky Mountain Bell	40 @ 45
Missouri and Kansas	52 @ 54
Missouri and Kansas, Script, 53 cents on the dollar.	
United	15 @ 17
Cumberland	70 @ 75
Wisconsin	108 @ 110
Bell of Missouri	147 @ 150

CHICAGO, April 19, 1886.

BOSTON ELECTRICAL NEWS.

The city of Malden, Mass., will be in part lighted by arc lights before the fall season. Main and Pleasant streets and Central square will be first favored with electricity as an illuminant.

At the Bay State sugar refinery a 200 light 16 candle-power incandescent plant has lately been started. This is the first Ball incandescent machine of so large a size.

There is much dissatisfaction at the failure of the aldermen to increase the number of arc lights for city lighting. Lanes and courts which formerly were dangerous after dusk are now in every case where the arc light has been placed as safe as in daylight.

If the wishes of the police force were followed the number of lights would be largely increased.

There is only a fair prospect for the passage of an act by the present legislature of Massachusetts to repeal the law permitting only 10 per cent. carbonic oxide in illuminating gas. It is an open secret that one local gas company would like to use a water gas plant as auxiliary to their present coal gas plant. The present limit could be raised so as to allow the present companies to use water gas mixed with coal gas. As, however, they fear that any change would result in a repeal of the law, they are using every means to prevent that change in the law. By so doing they effectually prevent competition from water gas companies.

As a result of so much controversy and discussion the gas companies are becoming less conservative, and are disposed to consider the advisability of operating electric plants in connection with their present business. The Marblehead Gas Light Company will probably be allowed to change its charter for this very purpose. Another year a general law will be presented to the legislature allowing all gas companies to do the same.

The coming season will see many of the best class of yachts lighted by incandescent lamps run by volta pavia batteries. Several parties are now negotiating for this very purpose. The cabins will be supplied with fans run by electric motors. The batteries will answer as an effective form of ballast.

The vote of the committee on mercantile affairs against recommending any legislation relative to the management and inspection of telephone companies practically settles this year the question of legislative interference in telephone matters.

The attempt of an expressman to charge extra for delivering a soda water tank on the ground it was heavier than when used, had more reason in his demands than the railroad company that wanted nearly double the amount to deliver a storage battery when charged than to return it after being used.

The attention of the educational public should be called to a dynamo for school purposes made by the Domestic Electric Manufacturing Company of this city. The machine has a capacity of one 16 candle-power incandescent light and furnishes current enough to show the principle of the arc light. As the armature has a number of sections the current is practically continuous and can be used in illustrating all the phenomena of electricity without the trouble and expense of batteries.

BOSTON, MASS., April 20, 1886.

Telephonic News

⁂ There is a brisk trade in private line telephones in Indianapolis. The closing of the general exchange causes this state of things.

⁂ Patents covering much of the valuable apparatus used on the telephone lines between this city and Philadelphia were issued to T. B. Doolittle, last week.

⁂ An effort is being made by the Inter-State Telephone Company, owning the Hopkins patents, to organize a company and start an exchange in Minneapolis, Minn.

⁂ Mr. Clark B. Hotchkiss, general agent, of the Kerite insulated wires and cables, has moved his offices to No. 16 Dey street, where he has secured more extensive office facilities.

⁂ There is a steady gain in the number of subscribers to the telephone system of the New York and New Jersey Telephone Company. Last month the gain was 112 subscribers. This is a well-handled system, popular with its patrons.

⁂ It is reported that Judge Jackson, recently appointed in place of Judge Baxter, deceased, is an intimate friend of Attorney-General Garland. It is to be hoped, nevertheless, that he can give an unprejudiced decision in the Government telephone suit which is to come before his court.

⁂ The telephone operator's calling seems to be disappearing in Indianapolis. One of the best equipped and most satisfactory exchanges in the country is now being closed out by the action of the State of Indiana, in enacting a law which made it impossible for the company to continue business without loss.

⁂ At a special meeting of the Council and Board of Aldermen of Indianapolis, last Saturday, a resolution was passed, with one dissenting vote in each body, requiring the Central Union Telephone Company to remove all its poles and wires from the streets and alleys within fourteen days, failing in which the Street Commissioner is instructed to cut them down.

⁂ A decree in accordance with the disposition made by Judge McKennan of the suit of the American Bell Telephone Company against the Clay Commercial Telephone Company has been entered in the United States Circuit Court at Philadelphia. The Clay Commercial Company is enjoined from infringing upon the Bell Company's patents, and the latter company is awarded nominal damages in the sum of $1. The case, it is understood, will go to the Supreme Court.

⁂ According to the Indianapolis papers, the people of that city are endeavoring to solve the problem in the following way: The telephone which the Indianapolis syndicate proposes to use, if granted the franchise withdrawn from the Central Union company, is the invention of a son of Judge West, the noted "blind orator," of Bellefontaine, Ohio, who is now in Indianapolis. In speaking of the assertion made at the conference of the City Council committee that the West syndicate is connected with the Central Union company, Judge West yesterday emphatically denied the truthfulness of the charge. He says that his son's invention operates on principles wholly distinct from those of the Bell telephone, and is not an infringement on Bell's patents. He gives the assurance that if the franchise asked by the syndicate of citizens is granted, the city will be furnished telephone service at the earliest day possible. He says that his son's invention has never been legally assailed by the Bell or any other company, for the reason that it has never been put in operation.

⁂ William E. Woodall, of Albany, the manager of the telephone office in Amsterdam, is missing, and with him some $500 of the company's money.

⁂ Telephone lines between the towns of eastern Ohio are becoming quite an essential feature of business. A new line is proposed between Bridgeport on the Ohio River and St. Clairsville, the county seat of Belmont, some thirty miles away.

⁂ Mr. Chas. E. Scribner, the well-known electrical inventor, a member of the staff of the Western Electric Company, of Chicago, was in New York the past week. Mr. Scribner has done good work in almost all departments of electrical science, particularly in the telephone field, where his labors on the multiple switchboard have received merited recognition.

⁂ A telephone receiver has been patented by Messrs. John E. Dann and John Lapp, of Honeoye Falls, N. Y. Two horse-shoe electric magnets are employed, arranged right and left from the diaphragm on its rear side, both armatures being connected with the diaphragm by rigid rods, so that both act simultaneously on the diaphragm to vibrate it as forcibly as possible, in order to give increased loudness to tone. Telephone transmitters form the subject of two patents also issued to these inventors. One of the forms is intended more particularly as an improvement upon instruments of the Reis type, having two small electrodes that are free to vibrate in connection with the diaphragm, and using a local circuit acting through the electrodes reversely to the main circuit, in order to neutralize the adhesion of the electrodes, and facilitate the required rapidity of vibration. The other form of transmitter is especially designed for the production of a loud-speaking instrument, capable of operating with a minimum expenditure of battery power or electromotive force, for which purpose a new and simple construction of the diaphragm is provided, with a novel mechanism co-operating therewith, the diaphragm having a central conical portion, the diameter of the base of which cone shall equal or slightly exceed that of the contiguous inner end of the mouth piece.

⁂ At Albany, last week, the Reilly Telephone bill was amended to fix at $7.50 the telephone charges per month in New York and Brooklyn, and $3 in cities of over 100,000 inhabitants. Mr. Coggeshall called up his resolution on Wednesday last, requiring all telephone companies to furnish information concerning their charges to the Senate. Mr. Pitts said that Burton N. Harrison, counsel for the Metropolitan Telephone Company, said the company paid $14 for royalty and got $150 rental; that its stock was $1,000,000, of which $600,000 was paid in; he was silent as to its dividends. The resolution was unanimously adopted, and at Reilly's request his Telephone bill was sent to the first committee of the whole. Mr. Coggeshall's resolution is as follows:

Resolved, That the Metropolitan Telephone Company of New York and every other telephone company organized or doing business in any or all of the cities, towns and villages of this State be required within seven days after the adoption of this resolution and the service of a copy upon the president or any officer thereof to report to this Senate under the oath of one of its general officers or managers a statement showing amount of its original capital; if increased, when and how, and in what amount; present nominal capital and whether the whole or any part of the stock thereof is owned or controlled by foreign corporations, and if so what proportion and how such ownership was acquired and consideration paid therefor; what surplus of earnings it now has and how invested; what dividends were declared and paid on its stock in 1885, and its gross and net earnings for that year; the actual first cost of each telephone and the gross and net rentals received therefrom; what royalty or license fee, if any, was paid by said company, and to whom and under what agreement; the number of telephones it now has in use by its subscribers and how much was paid therefor respectively, the average rate per month paid therefor and the aggregate sum received during 1885 from all sources for such services.

Personal Recollections of the Early Days of the Telegraph.

A PAPER READ BEFORE THE "ELECTRICAL SECTION" OF THE FRANKLIN INSTITUTE, MARCH 9, 1886, BY C. L. CHAPIN.

My earliest recollection of Professor Morse and the telegraph dates in the summer of 1844, when in company with my father, I was passing down Broadway in New York, and we met the professor.

Between the gentlemen a warm friendship existed, and my father as a scientist had felt great interest in the success of the telegraph, which had just then been put in operation between Washington and Baltimore. On parting the Professor presented me with a copy of the "alphabet," remarking that I might some day become connected with the enterprise.

Although then too young to understand the subject matter, it engaged my fancy and I soon mastered the alphabet, but did not suppose that I should ever become a telegraphist.

Shortly after this I entered the bookstore of Mr. Wm. Robinson, 208 Broadway, as a clerk, and became intimate with his son Charles, who was but a few years older than myself. He also became proficient in the alphabet, and we made frequent use of it in communications with each other.

In the year 1846 Col. Samuel Colt, of pistol fame, conceived the idea of establishing a line of telegraph between New York and Coney Island, to take the place of the semaphoric signal stations, then used for the purpose of announcing the arrival and departure of vessels at New York Bay.

This system was so manifestly imperfect and unreliable that Col. Colt saw that it must give way to improvement.

The line was built, with a station at the ferryhouse at Brooklyn, and the other in an old frame light house building at the point of Coney Island, about where the iron pier now stands. At this latter station I was placed, my home being in a fisherman's house near by. It was the only house on that desert of sand hills. A more desolate location one can hardly conceive of, and the recollection of the few months spent there has never left me.

So little was known practically of electrical matters that it was deemed *necessary* to place a six foot square sheet of copper for earth connection, or, I should rather say, *for attraction*, in the ferry slip at Brooklyn, and beyond low water mark at Coney Island.

Charles Robinson was the manager and operator at the Brooklyn end.

The telegraph worked well, but the loss of time incurred in transferring the reports from Brooklyn to the Merchants' Exchange in New York, by messengers, was so great that Col. Colt laid down a cable across the East River—this was an insulated wire drawn through a lead pipe. The Brooklyn office was then transferred to the Merchants' Exchange.

For a time the telegraph was successful and attracted much attention, but so many interruptions began to occur from the tearing up and breaking of the cable by vessels dragging their anchors in the East River, that the office had to be reopened in Brooklyn.

Col. Colt having his attention attracted in other directions, the whole matter became distasteful to him, especially as he had been financially a loser, and the line was abandoned.

The enterprise had been closely watched by the New York branch of a large shipping house in Hamburg, Germany, who conceived the idea of establishing a similar line between Hamburg and Cuxhaven, at the mouth of the river Elbe (about 90 miles), where semaphoric signals were being used. In July of 1847, the Messrs. Moering made very flattering offers to Robinson and myself, which were accepted, and we became the youthful pioneers of the Morse telegraph in Europe. Our trip was made on the good ship Northumberland, of the Black-ball Packet line to London, in 34 days.

On our arrival at Hamburg, we at once encountered bitter opposition from the owners of the Semaphoric system and others, on account of our youth and because, as they claimed, where our line of poles was placed the wire would attract the lightning from the passing clouds and no rain would fall.

This caused us considerable trouble from the farmers along the route, when we came to build the line; but we proceeded with the work. Before we had completed the line, a rainy season set in, and for about two weeks it seemed to rain every day. We crossed the river from the Hanoverian side at Hamburg, over the islands on which the old French bridge had been built by order of Napoleon I., using poles and cables similar to the ones used by Col. Colt at New York.

Now a new difficulty met us. The authorities of the city of Hamburg refused to allow any poles to be placed in the streets. This was overcome, after some experimenting, by placing an insulated copper wire in an iron pipe.

My evenings had been devoted to the instruction of a class of young Germans who were to become operators, with the difficulties to overcome of adapting the alphabet to suit the German language, and having at that time no knowledge of that language. However, I need scarcely say that we overcame all difficulties, completed our contract satisfactorily, and placed the line in successful operation.

At this time (the latter part of February, '48) we received notice that the King of Prussia had appointed a commission to examine the American telegraph, and inviting us to give an exhibition in the city of Berlin. Having provided ourselves with extra instruments on leaving home, we concluded to accept the invitation, although it required some pluck to do so, remembering that we were but boys—Robinson being not quite twenty-one and I only between eighteen and nineteen.

The exhibition was given, and we were higly complimented and promised a contract for an experimental line; but the Revolution broke out (March, '48), and for a time all government was destroyed.

After witnessing several street fights, as also that historical scene at the palace gate where the king was compelled to appear before the people, was ordered to take his hat off and did so, and being caught among the rioters at a barricade on "Wilhelm Strasse," when it was charged by the troops, we concluded that matters were rather too hot for even typical "Young America," and returned to Hamburg.

In June, '48, we received an invitation from the Russian Government, through its agent at Hamburg, to give an exhibition of the telegraph at St. Petersburg, which we gladly accepted.

Arriving in that city, we found accommodations and facilities arranged for us. A line of wire connecting the palace in St. Petersburg with the summer palace at Tzarskoye Selo (about twenty miles), upon which the Wheatstone dials were used, was placed at our service.

A number of exhibitions were given to the Tzar and Russian officials, and twice I had the pleasure of explaining the telegraph to the Emperor Nicholas.

We had made the acquaintance of the Messrs. Winans, the Americans who were building railroads in Russia, and received from them much good advice and attention. It was undoubtedly through their influence that the invitation had been given. They expressed themselves highly delighted with young American pluck, as they had hardly expected to have met with telegraphists quite so youthful.

As no immediate further result seemed probable, we returned to Hamburg after a delightful trip of one month, having been most courteously entertained, and all our expenses paid. As opportunities for success in the direction of any further introduction of the telegraph in the European countries, owing to their generally disturbed condition, seemed very uncertain, we turned our faces homeward, reaching New York from Bremerhaven after a passage of forty days.

I should say that while Prof. Morse had no connection with our trip beyond his interest in our success, he had written to the several

American ambassadors, highly recommending us, and his endorsement we found of great service.

In the latter part of 1849, I became connected with the New York and Erie Telegraph Line, owned by Ezra Cornell, and known as "Cornell's Line." The New York office was at the corner of Hanover and Beaver streets, and was managed by Chas. Robinson, with Wm. Butcher—who subsequently made a fortune in Australian telegraph enterprises—and myself as operators, and with two messenger boys.

Mr. Jno. Desmond, who, in a paper lately read before the Electrical Society of Chicago, very graphically describes the difficulties attending early telegraphing in this country, was one of these messengers. He says:

"Mr. Cornell was seldom present at the office, and whenever he was, made himself useful as operator, clerk, batteryman or messenger—in any capacity in which his services were needed."

In those days business was conducted in a simple, patriarchal fashion. Office opened at 8 A. M. and closed at 6 P. M., except on election nights, when Dr. Jones, who attended to the telegraphic business of the New York press, kept the office open to a late hour, providing liberal refreshments.

In the winter of 1850, Mr. Robinson suggested to Mr. Cornell the feasibility of opening a branch office up-town, there being then no office above Wall street.

A room was rented over a bank on the corner of Broadway and Canal streets, but after a week the operator (Mr. Chapin) was recalled.

As the room was rented for a month, a messenger (Mr. Desmond) was detailed there with instructions to hurry down to the main office with any business that might be left there.

During the three weeks he was in charge he recollects but one customer.

At the expiration of the month the office was closed as an unremunerative venture. There was in fact very little use made of the telegraph at that time, aside from cases of urgency. Many thought the telegraph a humbug, and gentlemen of the old school preferred to trust the mail to which they had always been accustomed. Nor is it surprising that they did. Things went from bad to worse. The office was moved to a fourth floor to save rents. Only one operator and one messenger were retained, the receipts barely paying their salaries.

For weeks communication with Dunkirk, where the line connected with the speed (Western) wires, was interrupted, but business was never refused. The express companies and the railroads made tolerable good time, and we used to railroad the business to points beyond the trouble on the line.

Soon matters became so terribly involved that all hands except Mr. Desmond were dispensed with. Mr. Cornell's finances were so low and his credit was so poor that he could not buy or get trusted for a ton of coal or a dollars worth of acid for the batteries. Even old envelopes were made to do double duty by reversing them for further use in covering messages.

The strain upon Mr. Cornell must have been terrible, yet he was never heard to utter a complaint. As no repair man could be employed the office was frequently closed while Mr. Cornell and Desmond were out looking for and remedying trouble on the line. Many a weary mile was traveled on foot for want of means to transport them and their tools. Of course the end came.

In 1853 a sale or lease of the line was made to the American Company.

Mr. Cornell's faith in the ultimate prosperity and value of the telegraph continued firm, and he became a zealous advocate of the union of all telegraph lines in the United States. The result of his labors in this direction was the organization of the Western Union Telegraph Company, of which he was the first president.

It was under the directions of Mr. Cornell that at Hanover and Beaver streets, when his line was at its best, the first attempt was ever made to work for long distances by joining his line with the Western lines, having "Cornell repeating relays" at the ends. The arrangements had been made without any notice, and one Sunday I met him by appointment at the office, and as I successively called and received replies from Cleveland, Detroit, Chicago, and finally Milwaukee, under his curt direction "go on, call ——.' My astonishment increased as the replies from each station came back. Milwaukee's was so faint as to be hardly discernible when Mr. Cornell simply said "switch off," turned on his heel and left the office.

After leaving Mr. Cornell's employ I was, in 1851, appointed superintendent of the Eastern Division of the New York and Erie Railroad Telegraph, which was in a very crude condition, and offices only opened at the principal stations. The telegraph was divided into two divisions; the Eastern from Pierhead, Piermont on the Hudson River to the Summit, Susquehanna, and the "Western" from thence to Dunkirk, Pa. Of this latter division the late L. G. Tillotson, of New York, was appointed superintendent. The railroad was using one track only, and all passengers and freight were transferred between New York and Pierhead by steamers. The road was divided into four Divisions; the "Eastern" from Pierhead to Port Jervis (Delaware Station), the "Delaware" thence to Susquehanna, and the others thence to Dunkirk.

In the winter of 1851–52 very heavy falls of snow occurred. One day on going into the office of Mr. J. J. Lawrence, the division superintendent at Pierhead, where my headquarters were, I found him exceedingly worried over the great number of freight trains that were locked up on the sidings along the whole division line, having lost their right to move. He had attempted to bring some of them in by "flagging" them by passengers trains, only to make the confusion the greater, and thereby endanger the passenger trains. It occurred to me that these trains *could* be moved by opening temporary offices and telegraphing their orders, and running from point to point.

The possibilities of accident to a passenger train by moving trains under telegraph orders in opposite directions over one track seemed too great to be risked, and only after persistent urging could I convince him of the feasibility of the plan, and that it offered the only means of bringing the trains under control.

The next morning he went to New York to consult with Mr. Chas. Minot, the general superintendent. Mr. Minot objected to assuming the responsibility, but was willing that Mr. Lawrence should do so, he feeling convinced that with proper care the plan *must* be successful.

Operators were taken from the main offices, temporary offices opened at short distances, and in three days the trains were all under control and order restored. This caused some confusion on the Delaware division, and Mr. Powers, the superintendent, requested that my headquarters should be moved to Delaware station. The success of the plan caused its adoption on the Delaware and Western divisions, but it was not until some months later, and after more stations had been established, that the movement of passenger trains by telegraph was attempted. This proved successful, and thereafter became of common occurrence.

The claim has been made by several parties of the introduction of reading telegraph messages by the sound of the instrument, thus leading to the abandonment of the register and paper, but I have always felt that, if it did not originate with me, it was at least a coincident discovery.

In 1852, while my headquarters were at Port Jervis, I was satisfied that the operators frequently broke the rules which prohibited them using the line for conversation, but, unless I examined the tapes of the registers at the stations, there was no way for me to detect them. As this would entail considerable labor, and was repugnant to my official pride, I almost despaired of being able to discover the guilty parties.

It occurred to me one day that as the armature of the register made distinctive sounds in indenting the characters in the paper, the ear could be tutored to read instead of the eye. Giving close attention to the subject, I soon mastered it, and to their surprise two of the operators found themselves suspended from duty and fined. Not being able to ascertain that I had been examining the tapes, they charged Hector Vail, the operator at headquarters, with having reported them.

A few weeks passed by, when one day, while I was sitting in my office, a message came over the line from an operator asking for leave of absence under circumstances so frivolous that before Vail could read off the message to me I said, "Tell him no!" Instantly Vail asked, "How did you know what he said?"

All evasions of a correct answer had no effect. Vail saw that he could relieve himself from the imputation of having been a tale-bearer, and I was compelled to explain it to him. Vail quickly learned to read by sound, and but a very short time elapsed before other operators were developing themselves as "sound readers" for the fun of the thing.

In the early part of 1854, having severed my connection with the Erie Railroad, I was appointed on the personal staff of Geo. W. Matsell, Chief of Police of New York, as sergeant in command of the telegraph.

The system had just been put in operation by Mr. Chas. Robinson, and consisted mainly of the same mechanism in dials, etc., as is now used by the police department of this city.

My connection with the police telegraph continued until 1855, when the paid Fire Department of New York was created in place of the volunteer system.

Mr. Chas. Robinson, who had introduced telegraphic connection between the Fire Department headquarters at the City Hall and the bell towers of the city, and had also invented and partly introduced a system for connecting the engine-houses, and was superintendent of telegraph, had a misunderstanding with the fire commissioners, was removed, and in August I was appointed superintendent.

The mechanism for connecting the engine-houses was found to be incomplete, and was succeeded by the Morse key, relay and bell. The headquarters were removed to its present location on Mercer st., above Prince, and several new bell towers established.

The city was divided into eight fire districts, the signals for which were struck upon the tower bells, and communicated to the engine-houses.

It seemed to me that the time had arrived to change the worn-out system which compelled the firemen to search for a fire until found, when its light or smoke did not show its exact location.

As the "districts," as struck upon the bells by the bell ringers, were governed by the location of prominent buildings, it seemed possible to select a greater number of these and give to each a distinctive signal, which, when communicated to the engine-houses, would send the firemen to the immediate vicinity of the fire.

Retaining the bell ringers as look-outs, the striking of fire signals upon the tower bells could be dispensed with.

After consultation with the commissioners and with Chief Kingsland, the plan was adopted and carried into effect November 15, 1865.

Later on the number of signals were greatly increased.

It was simply advance steps towards the "Gamewell system," which was introduced and completed in 1869 with most elaborate and perfected mechanism, under a contract made with Messrs. C. T. & J. N. Chester, of New York.

I do not deem it necessary to speak of my later connections with telegraph enterprises, as I have covered fully such ground as properly falls under the title of this paper.

---

* * The live field to-day is the electrical one. Manufacturers and dealers should remember this fact.

TELEGRAPHIC

.... The city of Toronto, Canada, has decided to adopt the Gamewell Fire Alarm at a cost of $19,000.

.... An English exchange suggests "telenym" as an appropriate word in place of "telegraphic address."

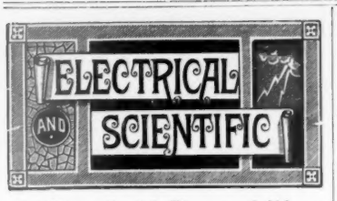
.... The offices of the Southern Telegraph Company at Selma, Ala., were destroyed by fire last week, the fixture and apparatus being saved.

.... The most important application before the Knights of Labor is for a renewal of the charter of lapsed District Assembly No. 45. This was the district of the telegraph operators, which was permitted to lapse after the failure of the strike of 1883. The telegraphers maintained their organization outside of the Knights of Labor, and have now decided to go back. There is no doubt that the application will be granted, and inside of a month it is thought that the telegraphers will again be in the order.

.... The Western Union Telegraph operators deny that there is any prospect of a strike of telegraph men. A Philadelphia gentleman who was prominently connected with the movement which culminated in the famous strike three years ago, in which the strikers were beaten but afterward were conceded nearly all they asked, said yesterday that there is no such organization now as the operators had then, and that, as a matter of fact, the operators possessed no organization whatever. Efforts have been made, he said, from time to time to reorganize the old brotherhood, but without success. None of the strikers have suffered on account of their connection with the movement.

.... The District Commissioners have written Mr. M. Marean, Manager of the Western Union Telegraph Company at Washington, D. C., refusing a permit to replace the telegraph poles on G street, between Seventh and Fifteenth streets, as requested by the company. The Commissioners say that Mr. Marean's letter of the 23d of March was referred to the District engineer officer, and that officer, after consulting with Col. Wilson, in charge of public buildings and grounds, who declines to agree to a common use of telegraph poles, reports that the request contained in the letter should be refused.

.... The argument on the motion for a stay of proceedings in the suit of General John G. Farnsworth, as receiver of the Bankers and Merchants' Telegraph Company against the Western Union Telegraph Company, was concluded last Friday in Supreme Court Chambers, before Justice Andrews. This suit was brought to recover $2,000,000 against the Western Union Telegraph Company for trespass in that they cut and took charge of certain wires in July last which General Farnsworth claimed belonged to the Bankers and Merchants' Company, but which the Western Union Company say were in charge of Edward Harland as receiver of the American Rapid Telegraph Company. John F. Dillon, A. J. Vanderpoel and Melville Egleston were present to press the motion, while Roscoe Conkling and Edward Lauterbach on the other side were reinforced by Colonel Robert J. Ingersoll, with Edward S. Stokes sitting behind them, an interested spectator. Mr. Conkling said that the motion was one of the boldest and most barefaced professional enterprises that had ever come within the range of his experience. It would not have astonished him if the Western Union Company came into court and declared that it alone was entitled to carry on the business of telegraphy in this country. The company had recklessly destroyed the property of a rival company and now sought to shirk responsibility for its acts of atrocious vandalism. Mr. Vanderpoel in reply said that he did not believe that this kind of talk would have any effect on the court, and argued that the motion was proper and should be granted. The decision was reserved.



* * Messrs. Lord & Thomas, of Chicago, have issued a very comprehensive catalogue of the newspapers of the United States and Canada, well arranged and classified. The list is a valuable one to all advertisers.

* * Mr. Horace A. Pitcher, inventor of the lighting arrester that bears his name, has arranged with the Gamewell Fire Alarm Company to sell his invention. This electric protector is already in use with a great many fire alarm boxes, and is being introduced into the electric light and telephone fields.

* * A very interesting discovery is said to have been made by the experts who are now examining the collection of papyri, consisting of many thousand rolls, which were found at El Fayoum, in Egypt, and were acquired by the Archduke Rainer. The experts declare that among the relics are several autograph letters of the prophet Mahomet.

* * The holding of an exposition at Cincinnati this year has been positively decided on, and a number of wealthy citizens have subscribed a guarantee fund of $100,000. The exposition will be opened on the first Wednesday in September, and run to the 9th of October. This will cover a period of five weeks and four days.

* * The engineer of a large mill at Rockford, Ill., played a joke on the working people of that city, April 1, by blowing the mill whistle at 5 o'clock instead of 6 o'clock, the proper time. The result was that hundreds got up an hour earlier than usual, turned up their clocks and watches to agree with the whistle and went to work an hour too soon.

* * The Institute Electro-Technique Montefiore, in Liege, was founded about two years ago, by M. Montefiore-Levi. It is intended to educate electrical engineers in the same manner as the continental polytechnic schools are intended for the education of mechanical and civil engineers. The average number of lessons given on theoretical electricity is 70 per term, and that of technical electricity is 140 per term.

* * Mr. A. J. Wright, of Wright, Berger & Co., of Cleveland, Ohio, is said to have succeeded in making a solderless copper float, a thing long regarded as impossible. This invention promises to revive the use of automatic steam arrangements of various kinds that have fallen into disrepute on account of the unreliability of ordinary floats. Besides being solderless, it is also said to possess, in a degree not heretofore attained, another essential element—strength, a 2¾ by 4½-inch float, standing long-continued tests of 200 pounds steam pressure without either collapsing or filling with water.

* * Where the owner of a patented invention was a director and officer of a corporation, and the latter appropriated and used such invention with his consent and acquiescence, the Supreme Court of Minnesota held (Deane *vs.* Hodge, assignee) that the owner was not necessarily precluded from receiving a reasonable compensation therefor by reason of his relationship to the company, but that such relationship, with other circumstances, was for the jury to consider in determining whether the license to use the patent would be implied to be used for or without compensation.

* * At the South Boston Iron Foundry the fifth and last of the large rifled cannon ordered by the Government has been successfully cast under the supervision of Captain Ligle and Lieutenant Borup, of the army, and Commander Lyon, of the navy. One of the five guns has a ten-inch bore, and the others are twelve-inch rifles. This gun, just made, was a twelve-inch one, and this is the fourth time that it was cast. Three times the casting proved a failure on account of unforeseen accidents, but finally succeeded.

If True, the Most Wonderful Discovery of the Age.

Under the above heading, a new departure in electrical science is reported from Boston, and we give the claims entire below:

A recent discovery or invention in electric science is announced, and, if the expectations of the inventor are only partially realized, it will be more wonderful than any previous discovery in connection with electricity, exceeding in value either the telegraph, telephone and all other electric systems of the world combined. The inventor asserts, and his associates hope that the experimental work now in progress will prove, that a constant current of electricity, under perfect control, can, by use of the apparatus devised by him, be induced from the elements without waste of material, or any created force outside of itself, and which, if accomplished, provides heat, light and power at mere nominal cost. If such a result can be attained—and scientific men assert its possibility—it is not necessary to enlarge upon its importance. It will, however, soon be decided—probably within the next ninety days—as it is now being developed by a syndicate of Boston capitalists, under the supervision of Mr. L A. Bigelow, No. 63 Equitable Building, Boston.

* * A stranger in New York, standing on the middle span of the great Brooklyn Bridge, views with wonder the beauties of New York harbor. He sees the great cities on each side stretching away for miles to the north, east, and west. Beneath his feet the rapidly running river, with scores of large and small steamboats coursing up and down. A large four-masted ship, bound for China, is passing under the great bridge in charge of a tugboat on its way to the sea, all hands are busy on deck, and as she passes from under the bridge the sailors give a shout. If this ship arrives out safely and returns to this port it will be nearly a year before she makes the round trip. Looking down the bay we see a great steamer going through the Narrows, bound in an opposite direction. Great black clouds of smoke ascend from her funnel. We know that the stokers away down in the boiler-room are replenishing the fires that are to furnish the motive power for the great ship, and must be attended to constantly for the next ten days. Apparently at our feet, but over a mile away, lies Governor's Island; a picture fresh, green and peaceful. The old fort, with cannons on top large enough for a small child to crawl in, the cannon balls piled in pyramids, the officers' houses and well-kept lawns remind one of the peep show in a pasteboard box that he made when a child. At our right we see a towering structure on an island—Bedloe's Island, three miles and a half away. It is difficult to realize the distance is so great, as everything stands out clear and bright on this beautiful spring day. This large structure is the pedestal for Bartholdi's great statue of "Liberty Enlightening the World," which is to be one hundred and forty two feet high, and will be completed this month. The engineers and workmen who constructed the great statue will arrive from France in May, and commence putting in place this great wonder of modern times which will tower three hundred and twenty feet above the waters of the bay; a beacon light that will show far out at sea, and a welcome to all who enter the beautiful harbor from oppressed and overcrowded Europe to make their homes with us. This great statue is a gift from one great nation to another, which will stand for ages to cement the friendship of France and America. The committee in charge of the construction of this great pedestal are nearly through with their labors. And all who desire a memento, in the form of a miniature statuette of this great work, with a certificate of subscription from the committee to show to their children's children that they helped build the great pedestal, should subscribe at once. The statuette is a work of art, and has found a place in thousands of homes. Statuettes delivered by mail or express on receipt of subscription price, one dollar, five dollars and ten dollars each. All remittances should be addressed to Richard Butler, Secretary, American Committee of the Statue of Liberty, 38 Mercer street, New York.

Mr. Vail's Views on the Underground Wire Question.

The largest telephone company in the world is the Metropolitan Telephone and Telegraph Company of New York city. The expense of placing all its wires under ground would reach an immense figure, but realizing the importance of the question the company has been experimenting for more than a year with a view to obtain a practical solution of the problem. During this time it has communicated with the Electrical Subway Commission, and even before the appointment of that board it had applied to the city authorities for permission to lay a portion of its wires under ground for the purpose of experiment, and even at the present time there are already many miles of wire of this company working satisfactorily under ground, and it is now calculating to lay six miles of conduit next month, if permission will be given to do so.

The president of the Metropolitan Telephone and Telegraph Company is Mr. Theodore N. Vail, the former general superintendent of the fast railway mail service, and until recently general manager of the American Bell Telephone Company, and he is a gentleman of well-known business sagacity and ability. He has given this subject his closest attention. Gen. H. S. Huidekoper, the vice-president of the company and the general manager, was formerly postmaster of the city of Philadelphia for five years and has joined with Mr. Vail in a careful study of the effect likely to be produced upon the telephone wires when the time shall come for their transfer from the poles to the earth.

The subject of the vast undertaking which must be accomplished to bury these miles upon miles of wires can scarcely be comprehended, and the officers of this company, as well as its thousands of patrons throughout the city, feel that no hasty action should be taken, whatever course the commission may finally pursue. A failure of the telephone wires to do their duty, as is well said by the New York *Daily World*, would entail a loss almost incalculable to the business community. It would be almost complete destruction, to such an extent does the telephone enter into the economy of the business of the present day.

In discussing the matter in a recent interview Mr. Vail gave a few facts concerning the working of electric wires under ground, both in this country and in Europe, which are of special interest at this time. He has taken the pains to consult European experts who have made this matter a long and assidous study. Mr. Vail said:

"The popular impression which is extensively prevalent that the electric wire companies do not desire to place their wires underground is erroneous. On the contrary, a very large number of Western Union Telegraph wires in this city are at the present moment beneath the surface of the earth, and the Metropolitan Telephone Company has even now 614 miles of telephone wires in New York working under ground. The telephone companies in Pittsburg, Chicago, Boston, Washington and Brooklyn have a large mileage of wires working in this manner and are making arrangements to largely increase this during the coming season.

"It is not as generally believed that all or even a majority of the electric wires abroad are under ground. The fact is that in London there is an exceedingly small proportion, if any, of the wires of the telephone company beneath the surface. The same is also true of Antwerp, Brussels and other continental cities where the telephone is most in use. In Paris the wires are run through the sewers and cannot, therefore, be properly said to be underground, as the term is understood here, for the reason that these sewers, as is well known, are immense avenues traversing the whole extent of the city under the streets. The Government telegraph wires in London are under ground, as they are also in many of the larger cities in Germany.

"The question as to how far a telephone wire is effective if buried in the earth is still undetermined, but the best experts seem to agree that the limit will be not greater than ten or fifteen miles. The general manager of the Paris system, after exhaustive experiments, has arrived at the conclusion that the full limit has been attained at fifteen miles.

"Contrary to the general impression that the company controlling the telephone wires in this city does not desire to place its wires beneath the surface, the fact is that the Metropolitan Telephone and Telegraph Company has made repeated applications not only to the Board of Commissioners of Electrical Sub-Ways, but before the organization of that Board directly to the Department of Public Works, for permits to place its wires underground, its desire being solely to develop this system to its fullest extent as fast as the practical tests founded upon tests which it instituted and upon which it has expended large sums of money would seem to warrant. That its desire to do this is sincere is evidenced by the fact that, as before stated, in other cities the telephone company have placed a large mileage of their wires under the surface, those companies being to a great extent controlled by the same parties which control the Metropolitan Telephone Company.

"It might be said of this as of any other new enterprise that any attempt to at once place the entire system of wires under ground, without any preliminary or gradual feeling of the way, would be unwarranted. In undertaking a vast work, entirely novel and to a certain degree a pure experiment, they would not feel justified in jeopardizing the entire service or their entire capital, but on the other hand it would be anxious to progress as rapidly as the conditions warrant. It would seem, therefore, that too stringent measures on the part of the Legislature might result in crippling the entire service.

"In view of all these considerations and the possible fact that a very large expenditure will be required to complete this work, and that possibly all or at least a very large proportion of the investment already made will become absolutely worthless, it seems eminently proper to ask whether the action of the Legislature in cutting down rates is wise or judicious or even fair to a corporation which already pays a large amount of taxes without a single protest for all the franchises which it enjoys from the State."

In concluding his interview Mr. Vail touched upon the proper course to be pursued by the Legislature in its dealings with the telephone companies and said:

"It would appear that the first thing to do would be for the Legislature to see that underground work laid out a year since by the telephone company and for which it asked permits should be allowed, and the result made known as soon as possible, after which the propriety of further directing in behalf of the people might be a proper subject for consideration by the Legislature, so that the best interests of the public at large and the company may be served without undue detriment to either."

*** The Cambria Iron Co. are building a private telephone line from Johnstown, Pa., to Grapeville, Pa., a distance of 44½ miles.

*** When a citizen of Indianapolis wants anything he goes after it. Formerly, in the degenerate and unprogressive past, he telephoned.

*** Indianapolis Housewife—"Henry, be sure to tell the grocer to send us a barrel of flour and ten pounds of sugar, and order a ton of nut coal, and engage a sleeper for Aunt Jane to Chicago to-night; and tell the livery man to call here promptly at 7:30, and see the butcher about that mutton roast, and——"

Henry Clay Lightbrain, Representative of 4th District—"Why don't you use the telephone? It will take me half a day to go to all these places."

Wife—"Our telephone was taken out early this morning on account of that law reducing the rates you had passed."

H. C. L.—"Oh! Ah! Ahem!"

Electric Light Legislation in France.

Whatever be the object of legislation with regard to electrical industries in France, it seems that the *Syndicat des Industries Electriques* views all attempts at officious interference with suspicion. Such, at least, is the impression gleaned from a very interesting address which M. P. Lemonnier, the president, recently delivered to the members of the syndicate. According to this authority the total capital employed in electric lighting and transmission of energy in France is £2,640,000, of which sum £2,600,000 is represented by electric lighting, leaving only £40,000 to the other application of electricity. In giving these figures M. Lemonnier explains that they represent the capital expended from the time that electric light was first introduced (about ten years ago) up to the present moment on machinery for the generation of electricity, on conductors, and on lamps. The pressure employed varies between 50 and 1,500 volts, and the currents are both direct and alternating. The total number of fatal accidents which have happened during the last 10 years in France, and which are directly attributable to the effect of electric shocks on the human system, is eight. A ninth case is doubtful, as it could not be ascertained whether death was caused by a shock or by the person becoming entangled in a belt. M. Lemonnier points out that in comparison with the capital employed, the electric lighting industry has enjoyed greater immunity from fatal accident than any other industry which could be named, and that there is therefore no need for special legislation by the State for the purpose of more effectually protecting life. As regards the protection of property, he points out that in the opinion of insurance companies, firemen, managers of theaters, and other persons of experience in the fire risks incurred by artificial lighting, electricity is much safer than gas, and no special legislation is needed on that account. He admits that for transmission of energy over long distances, where the cables have to be carried along public roads, or over ground outside the property over which the owner of the installation has control, some kind of legislation as to the manner of erecting and insulating the conductors would be desirable; but he is distinctly opposed to any legislation which would interfere with the details of an installation erected entirely on private ground. He is also opposed to limit the potential in any way, but he would agree to have the kind of insulation necessary for every potential fixed by law.

Strange Freaks of Lightning.

A curious freak of lightning is reported from Pearl River, N. Y., whereby James Serven, a merchant of that place, narrowly escaped being blinded. While the severe thunderstorm of Wednesday afternoon was in progress, Mr. Serven and a customer stood in the store door watching the changing cloud effects. Just then lightning came down with its briskness and struck a huge oak tree about sixty feet east of where the men where standing. The fiery fiend traveled down the side of the tree and into the ground with a force that plainly showed it meant business. Earth and gravel were sent flying in all directions. Mr. Serven and his companion think the most of it came their way. Mr. Serven's lip was badly cut and several abrasions of the cuticle are observable; or rather, they would be but for the little patches of plaster which decorate his face. His friend's ear was "flicked," but fortunately neither of the men was badly hurt. The bark is torn cleanly from the oak.

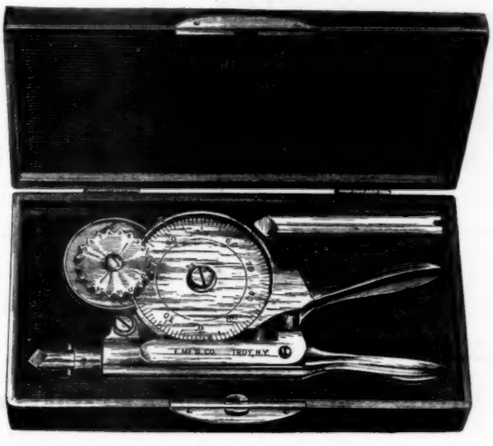
In a slight thunder shower in Yorktown, Westchester County, on Thursday night, a bolt of lightning struck the house of Munson E. Frost and cut up some curious antics. It first struck the chimney, knocking the bricks off one side of it, and then ran along the ridge pole of the roof, ripping off one row off slates to the gable end of the house, where it went through a window, down the wall into the kitchen, where it stirred up the pots and kettles and then jumped out into the dining-room, where it landed in a cuspidor and split it as clearly in half as though cut with a saw. Here it exhausted itself. Nobody was hurt, but some of the family were agitated.

Change of the Detroit Electrical Works.

The Detroit Electrical Works have closed their New York office, 33 Astor House, and have made arrangements with the well-known house of E. S. Greeley & Company, successors to L. G. Tillotson & Company, 5 and 7 Dey street, to represent them in the east. Messrs. E. S. Greeley & Company will carry a full line of the Detroit Electrical Company's manufactures, which they will sell at factory prices. Mr. F. H. Angell, the former manager of the Detroit Electrical Company's New York office, has resigned, to go into business with the Kerite Company.

The Pratt Speed Indicator.

In this speed indicator the toothed dial is carried by an arm hinged to the main frame, and within the frame is journaled a loosely-turning worm-spindle. The main frame and arm are provided with hand grasps. When in operation the spindle is turned loosely in its bearings by the shaft. The operator by means of the handle of the pivoted arm can instantly gear the indicating dial with the worm shaft at the very beginning of the period of time for which the velocity is to be determined. At the end of each period the dial is as quickly disengaged—the recoil of a spring, when the handle is released, forcing the pivoted arm at once from the spindle. A set screw governs the approach of the dial-teeth to the worm, and prevents the dial-teeth from being forced or crowded in upon the spindle with so much friction as to abrade or wear off their faces. The instrument manufactured by the Electrical Manufacturing Company, of Troy, N. Y., is finished in first-class style, and can be used for right or left motion.



PRATT SPEED INDICATOR.

—— At the last meeting of the South Wales Institute of Engineers a paper "On Recent Improvements in Apparatus for Lighting and Transmission of Power by Electricity," read by Mr. S. F. Walker, led to a discussion as to the relative cost of maintaining electric lights, gas lights, and oil lamps. Mr. W. H. Massey said, although he did not place much faith in batteries as a rule, he thought that portable lamps in which the electrical energy was produced by some sort of self-contained apparatus would be safer in mines. The difficulties of carrying electric light conductors through the shifting ground of South Wales collieries would probably be overcome in more ways than one, and lights in safe positions might some day be introduced under ground, but portable lamps fed by movable wires were out of the question in fiery mines. The discussion having afterwards turned on the difficulties in diffusing light created by the restriction of the Electric Lighting Act, of England, Mr. Carr said he thought there were practical difficulties in the way of diffusing or distributing the light which were much more important than any legislative enactments. It was argued, in reply, that the necessity for using large and expensive mains arose through the limitation of the pressure by Act of Parliament. If the Act were modified to allow an increase of pressure the same amount of energy could be transmitted by means of small and economical mains.

—— The Stamford Electric Light Company has contracted with the Schuyler Electric Light Company for 100 arc lights and 150 incandescent lights, all complete. As this company has been organized for five years before selecting a system, this contract speaks well for the Schuyler Company's apparatus.

—— The Gas Commission of New York, on Friday last, opened bids for the lighting of the streets and parks by electric lights. The Brush Electric Light Company and the United States Illuminating Company each offered their lights for seventy cents for each lamp. As the Comptroller was not present an adjournment was taken to Monday next.

—— In the city of Troy, N. Y., there are burning nightly 113 electric lights, for which there was paid during the year the sum of $2,830.88. There are also in use 529 gas lamps, at a cost (including for repairs) of $20,981.78, making the total expense for lighting during the year, $23,812.66.

—— Some 240 incandescent lights have been fitted up on board the barbette ship Collingwood by Messrs. Siemens Brothers, and in other respects progress is being shown in the introduction of electrical progress in the English navy. Henceforth an electrical staff will be held at the Chatham, Sheerness and Devonport Dockyards for electric lighting and other work, while Portsmouth will continue to be the headquarters of torpedo experiments.

—— It is reported from England that the extensive suite of rooms occupied by Lloyd's in the Royal Exchange has been successfully lighted by electricity by means of storage cells. The machinery and apparatus are placed in two large vaults in the basement of the Exchange, the current being produced by means of two Elwell-Parker four-pole, shunt-wound dynamos, each giving 200 amperes and 75 volts. These machines are driven at a speed of about 600 revolutions per minute direct from a compound semi-fixed engine of 20 horse-power nominal, but which is sometimes worked up to 45 horse-power. This plant supplies the current to about 400 Swan glow lamps each of 10 candle-power and 50 volts. The installation was completed and the lighting began towards the close of last year, and proved most successful in all respects save one, viz., that complaints were made as to its noise. These were removed by the introduction of storage cells, which are charged from the dynamo before and, if necessary, after business hours. The battery room adjoins the dynamo room, and in it are compactly arranged two sets of accumulators, each set being composed of twenty-nine batteries, and each battery consisting of three cells joined in parallel, giving 180 amperes. The twenty-nine sets of threes are joined up in series, giving 58 volts. There is therefore a total of 174 cells. They are all the Electric Power and Storage Company's cells, and the combined accumulators when fully charged are capable of supplying the current to the whole of the lamps for about eight hours.

ELECTRIC LIGHT NEWS

—— Troy, N. Y., has finally decided to contract for 250 arc lamps, at 47 cents each per night.

—— The incandescent light is to be placed in the Methodist Church and Wyoming Seminary, Kingston, N. Y.

—— Mr. J. R. Simpson, of Kansas City, will represent the Westinghouse Electric Company at that point.

—— D. M. Yost & Co., of Norristown, Pa., have had their carpet establishment lighted by the incandescent light, using lamps of 150 candle-power.

—— The Columbus, Ohio, city council will order an increase of the electric lights in use by the city, so as to illuminate several additional streets of the city.

—— James Tobin, of this city, was found dead in his room Saturday morning, suffocated by gas This illuminant seems to be very dangerous.

—— "Special Bulletin No. 2" has just been issued by the Armington & Sims Engine Company, of Providence, and contains much valuable information concerning setting up and starting and running engines.

—— The extensive establishment of the Southern Brewing Company, New Orleans, has been fitted up with the Sawyer-Man incandescent system, through the consolidated Electric Light Company, of this city.

——Mr. J. F. Morrison, of Baltimore, has extended the facilities of his electrical works, and now has a department devoted to the manufacture of mathematical, optical, philosophical and scientific instruments generally, as well as electrical.

—— An electric light company has been organized in Sharon, Pa, with six local capitalists as projectors. They have been granted an ordinance giving them exclusive privileges and have made application for a charter.

—— The offices of the Electrical Accumulator Company, will remove from 15 Cortlandt street to 44 Broadway, April 30th. The officers of this Company are: T. N. Vail, president; O. E. Madden, vice-president; E. J. Hall, Jr., secretary, and S. L. Parrish, treasurer.

—— Strong efforts are being made to induce the Schuyler Electric Light Company to remove its factory to Holyoke, Mass. This company is now employing over 200 men, and business is increasing to an extent which will force them to increase their facilities largely at a very early day.

—— The plant of the United States Illuminating Co. (Weston system), in the Mutual Life Building, corner of Nassau and Liberty streets, this city, is one of the finest specimens of incandescent lighting in the country, and is quite a point for visitors to New York who are interested in this form of lighting. The Illuminating Company has reason to be proud of the work it has done here.

—— At Los Angeles the Pasadena Gas and Electric Light Company, with a capital of $25,000, nearly all of which has been subscribed, has organized with the following list of officers and directors: President, Hon. C. T. Hopkins; vice-president, Gen. Edwin Ward; secretary, R. Williams; treasurer, Hon. P. M. Green; engineer, Dr. E. Mellis. Other directors: Col. O. S. Picher, E. C. Webster, G. A. Swartmont and S. W. Buckbee. The works will be situated on Fair Oaks avenue, and made in the most approved manner. The heat used for making gas will also be used in furnishing power for the dynamo for electricity to move the street cars and illuminate the streets.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 13, 1886.

339,625 System of telephonic communication; Thomas B. Doolittle, Bridgeport, Conn.

339,626 Switchboard and central office apparatus; Thomas B. Doolittle, Bridgeport, Conn.

339,627 Combined annunciator and spring-jack; Thomas B. Doolittle, Bridgeport, Conn.

339,646 Wire rope or cable; Andrew S. Hallidie, San Francisco, Cal.

339,672 Short-circuiting device for magneto calls; George A. Mason, County of Middlesex, England.

339,688 Synchronizing device for clocks; Chester H. Pond, Brooklyn, N. Y.

339,706 Electrical attachment for exhibiting devices; Wm. T. Smith, Providence, R. I.

339,714 Electric switch; Elihu Thomson, Lynn, Mass.

339,718 Individual electric signal; Ernest P. Warner, Chicago, Ill., assignor to the Western Electric Company, same place.

339,745 Telephone transmitter; Daniel Drawbaugh, Eberly's Mill, Pa., assignor to the People's Telephone Company.

339,766 Telephonic apparatus; Henry N. Hastings, Lynn, Mass.

339,772 Unipolar dynamo-electric machine; Carl Herring, Philadelphia, Pa., assignor of one-half to Chas. H. Banes, same place.

339,773 Compensating resistance for dynamo electric machines; Carl Herring, Philadelphia Pa., assignor of one-half to Charles H. Banes, same place.

339,787 Composition of matter for electrical insulation; Edward D. Kendall, Brooklyn, N. Y.

339,826 Electric governor for steam engines Axel O. Tengvall, New York, N. Y.

339,839 Dynamo-electric machine; Charles Batchelor, New York, and Henry E. Walter, Clifton, N. Y.

339,844 Underground conduit; John Beeler, Cincinnati, Ohio, assignor of one-third to Elijal Coombe, same place.

339,908 Electric lamp; David B. Macdonald and Hannibal W. Woodman, Hamilton, Ontario, Canada.

339,909 Convertible telegraph key; James A. Maloney, Washington, D. C.

339,930 Apparatus for the production of high vacuums; Albert L. Runmann, Pittsburgh, Pa., and Charles G. Ott, Newark, N. J., assignors by direct and mesne assignments to George Westinghouse, Pittsburgh, Pa.

339,942 Circuit for electric railways; Sidney H Short and John W. Nesmith, Denver, Col.

339,960 District signaling apparatus; John C. Wilson, Boston, Mass.

340,028 Telephone switch; John A. Blattau and George A. Boyden, Baltimore. Md.

340,046 Underground electrical conduit; Daniel N. Hurlbut, Chicago, Ill.

340,065 Carbon holder for arc lamps; Simon H. Stupakoff, Hartford, Conn.

RE-ISSUES.

10,711 Hotel annunciator and fire alarm; Albert T. Hess, Des Moines, Iowa, assignor to the Iowa Electrical Company, same place.

Patents issued April 6—Crowded out last issue.

339,341 Apparatus for laying submarine cables underground; Henry C. Spalding, New York, N. Y.

339,363 Automatic cut-out and lightning arrester; Perley P. Belt, Columbus, Kan.

339,371 Cap iron for poles for suspending electric lights; Thomas H. Brady, New Britain, Conn.

339,381 Electric signal recorder; Andrew J. Coffee, Portland, Oregon.

339,417 Lightning arrester; John Horen, Omaha, Neb.

339,431 Apparatus for electrotyping; William J. Ladd, New York, N. Y.

339,449 Multiple telegraphic repeator; William Maver, Jr., Jersey City, N. J.

339,499 Telephone transmitter; Silvanus P. Thompson and Philip Jolin, Bristol, County of Gloucester, England.

339,500 Magneto telephone; Silvanus P. Thompson, University College, Bristol, England.

339,501 Telephone transmitter; Silvanus P. Thompson, London, County of Middlesex, England.

339,540 Apparatus for treating wines and liquors by electricity; Edwin J. Fraser, San Francisco, Cal

339,541 Process of treating wines and liquors by electricity; Edwin J. Fraser, San Francisco, Cal.

339,558 Stock quotation telegraph; Patrick Kenny New York, N. Y.

WHEN WRITING for Catalogues & ordering Articles advertised in our columns please mention that you saw the advertisment in the ELECTRICAL REVIEW.

DETROIT ELECTRICAL WORKS,

MANUFACTURERS OF

ELECTRIC SUPPLIES,

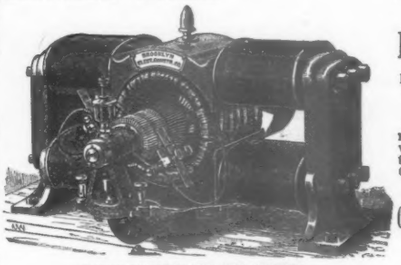
INCLUDING

Medical Batteries, Skeleton and Box Bells, Burglar Alarms, House Annunciators, Fire Alarm Boxes, Pins and Brackets,

INSULATED MAGNET, TELEPHONE and ELECTRIC LIGHT WIRE.

GENERAL OFFICES and FACTORY Detroit, Mich.

A. M. KALBFLEISCH, President and Treasurer.
ALLAN P. NICHOLS, Vice-President.



KNOWLES-MOFFATT ARC SYSTEM.

WILLIAM W. GOODRICH, Secretary.
E. R. KNOWLES, Elec. and Superintendent.

THE BROOKLYN

Electric Construction Co.

Electric Apparatus, Dynamos, Arc Regulators, Electric Motors, etc. Electric Light Plants a Specialty.

Perfect automatic regulation of Dynamos, Lamps and other transmitting devices in circuit. Illumination steady, intense, simple and effective in every way. Cost greatly reduced.

MANUFACTORY,
Cor. Washington & York Sts. Brooklyn.

NEW YORK OFFICE,
71 and 73 Broadway.

ELECTRIC LIGHT

FOR THE

MAGIC LANTERN!

AN EDISON

Spiral Incandescent Lamp of 40 Candle Power,

With adjustable stand for lantern, portable battery and two extra lamps for $40. Easily managed. Gives as good effects as ordinary calcium light.

Edison Lamps, Batteries, Instruments, Motors and Supplies.

Send five cent stamp for postage on catalogue.

THE STOUT-MEADOWCROFT CO.
Authorized Agents for Edison Lamp Co.,
21 Ann Street, New York.

FRENYEAR & RAZEE,

352 Washington Street, Boston, Massachusetts.
Manufacturers, Wholesale & Retail Dealers in

ELECTRICAL GOODS.

ELECTRIC LIGHT SUPPLIES A SPECIALTY.

Agents for the EXETER STEAM ENGINE for Electric Lighting and for SUNLIGHT CARBONS
Send for catalogues "B" and "C" of Electric Light Supplies and the EXETER STEAM ENGINES.

Factory, EXETER, N. H. New York Office, 67 ASTOR HOUSE.

OKONITE

TRADE MARK.

CHARLES A. CHEEVER, President. WILLARD L. CANDEE, Treasurer
THE OKONITE COMPANY.
MANUFACTURERS OF
Underground, Aerial and Submarine
INSULATED WIRES AND CABLES,
No. 13 PARK ROW, NEW YORK.

Leclanché,

The Standard Open-Circuit Batteries of the World.

GONDA (FORMERLY PRISM) CELL, COMPLETE.

GONDA and DISQUE,

The Only Genuine Leclanché Batteries

Are those which bear this
LABEL and the Trade-Mark, GONDA.

DO NOT BE IMPOSED UPON BY IMITATIONS.

If dealers have not the **Genuine Battery**, send direct to us for Price-List.

THE LECLANCHÉ BATTERY CO.,
149 West Eighteenth Street, New York.

GENUINE DISQUE CELL, COMPLETE.
The Porous Cell also bears Label.

Standard ✣ Electrical ✣ Works,

MANUFACTURERS OF

TELEGRAPH AND TELEPHONE APPARATUS,

Hotel and House Annunciators, Burglar Alarms,

CALL BELLS, "POST'S" MAGNETO BELLS,

PINS and BRACKETS, BATTERIES, &c., &c.

IN STOCK:—FULL LINE

IRON, STEEL and HARD-DRAWN COPPER WIRE, Delivered at Lowest Prices.

☞ ESTIMATES FURNISHED. SEND FOR CATALOGUES AND PRICES. ☜

Cincinnati, Ohio, U. S. A.

BARRETT'S CHLORIDE OF SILVER TESTING BATTERY,

the most constant, compact and economical Test Battery ever made. These Batteries are mounted in hard rubber cells, enclosed in polished mahogany cases.

PRICES.

In Polished Mahogany Case with Current Reverser.

50 cell	Battery, 7x7x12½ inches	$60 00
32 cell	Battery, 6x7·10½ inches	40 00
94 cell	Battery, 6x7x7½ inches	33 00

In Plain Case Without Current Reverser.

16 cell	Battery, 5½x6¼x5 inches	20 00
12 cell	Battery, 5½x5¾x5 inches	15 00
9 cell	Battery, 4⅝x5⅝x5 inches	12 00
6 cell	Battery, 4⅝x4½x5 inches	10 00

SOLE AGENTS,

E. S. GREELEY & CO.,

SUCCESSORS TO

L. C. TILLOTSON & CO.,

Manufacturers, Importers and Dealers in

Telegraph, Telephone and Electrical Supplies of Every Description.

5 and 7 DEY STREET, - - NEW YORK.

Brady Electric Light Mast Arm.

H. M. LINNELL, Selling Agent, Hartford, Conn.

T. H. BRADY, Patentee and Sole Manufacturer

NEW BRITAIN, CONN.

NEW YORK, *January* 5, 1886.

T. H. BRADY, Esq., New Britain, Connecticut,

Dear Sir—I am much pleased with your Mast Arms for arc lamps. They are simple in construction, low in price, and perfectly adapted for all purposes where projecting lamps are required. Yours truly,

THE BRUSH-SWAN ELECTRIC LIGHT CO. OF NEW ENGLAND,
J. B. POWELL, *General Manager.*

BROOKLYN, NEW YORK, *December* 16, 1885.

MR. THOS. H. BRADY

Dear Sir.—Some few months ago we substituted your Mast Arms for some swinging lamps (i. e., lamps suspended in the middle of the roadway), and find them a vast improvement. We were troubled with the old style by carbons slipping by when the trimmer was pulling lamp out to its position. We find no such trouble with your Mast Arms, and are very much pleased with same. Should be pleased to have you send anyone to inspect same.

Respectfully,
MUNICIPAL ELECTRIC LIGHT CO.,
CHAS. COOPER.

T. Z. R. WIRES AND TAPE.

High Insulation, Thoroughly Waterproof, No Abrasion.

E. H. BATCHELER, Sole Agt.

328 Washington Street, Boston, Mass.

The MATHER ELECTRIC CO.

Manufacturers of

COMPLETE SYSTEMS OF ELECTRIC LIGHTING

AMERICAN ELECTRIC MFG. CO.

ON AND AFTER THURSDAY, APRIL 1ST, 1886, EXECUTIVE OFFICES WILL BE IN

MUTUAL LIFE BUILDING, 146 BROADWAY, NEW YORK, U. S. A.

BOARD OF OFFICERS.

EDWARDS H. GOFF,	President and General Manager.
LEWIS MAY,	Treasurer.
WILLIAM H. BAKER,	Secretary.
H. W. BURGETT,	General Agent.

TRUSTEES.

HON. H. S. HYDE,	President Agawam National Bank, Springfield, Mass.
HON. L. M. BATES,	Formerly of Messrs. Bates, Reed & Cooley, New York.
LEWIS MAY,	Banker and Director Mutual Life Insurance Co., New York.
A. B. CHANDLER,	Of the Mackay-Bennett Ocean Cable Co., New York.
ROWLAND N. HAZARD,	Of Messrs. Caswell, Hazard & Co., and President American Loan and Trust Co., New York.
H. P. FROST,	General Manager Southern New England Telephone Co., New Haven, Connecticut.
HENRY F. GILLIG,	General Manager American Exchange in Europe, New York and London, England.
HON. JOHN J. KIERNAN,	Kiernan's Financial News Bureau, New York.
COL. SILAS GURNEY,	Proprietor Tremont House, Boston, Massachusetts.
CHAS. B. WHITING,	Of Messrs. Chas. B. Whiting & Co., Bankers, Worcester, Massachusetts.
HENRY C. ADAMS,	New York Agent Holmes, Booth & Haydens Co., New York.
EDWARDS H. GOFF,	President of the Company, New York.
H. W. BURGETT,	General Agent of the Company, New York.

EXECUTIVE COMMITTEE.

L. M. BATES, LEWIS MAY, A. B. CHANDLER, EDWARDS H. GOFF, H. W. BURGETT.

REGISTRARS AND TRUSTEES.

AMERICAN LOAN AND TRUST CO., 113 Broadway, New York.

This Company is engaged in the manufacture of DYNAMO MACHINES and LAMPS, and the construction of ELECTRIC LIGHTING STATIONS for lighting CITIES and TOWNS under the well-known

"AMERICAN SYSTEM" OF ELECTRIC ARC LIGHTING. (Wood's Patents.)

SPECIAL ADVANTAGES OF THIS SYSTEM. Completeness, durability, steadiness, quality of light and economy of power. The Wood dynamo electric generator occupies less space, is lighter, requires less motive power, and costs less than others capable of producing an equal number of lights. There is less firing or flashing of the commutator, and consequently less loss of energy and wearing of the parts from this cause than is the case with other machines. It requires no oiling or other attention than to be kept clean, and its extreme simplicity enables it to be operated with the minimum of skill and attention. The current regulator and signalling apparatus, by which the machine is made to generate the exact current required of any number of lights from one to its full capacity—as they are turned off and on without change of speed or waste of power—is simple, effective, and safe. Its lamps are reliable in operation, the carbon-regulating mechanism being absolute in its control, durable, and unaffected by changes of temperature or weather. They are of ornamental design, and the steadiness and purity of light produced are unequaled at the same expenditure of power.

ESTIMATES FURNISHED for Central Lighting stations, or isolated plants, for either the American Arc Lighting System or Edison Incandescent System, or for both combined.

SPECIAL ATTENTION given to installing isolated plants in Mills, Factories, Shops, Railroad Buildings, etc.

CONSTRUCTION WORK. Proper construction and installation of central stations and isolated plants is of great importance to insure safety and economy. The American Company has done more of his work than any other company in the United States, and its work is known to be superior to that of other companies. Illustrated Pamphlet and Descriptive Circular free. Address,

American Electric Mfg. Co., Western Union Telegraph Building, cor. 23d St. and 5th Ave. New York.

D. W. Baker. C. O. Baker, Jr.

BAKER & CO.,

Importers, Melters and Refiners of

PLATINUM,

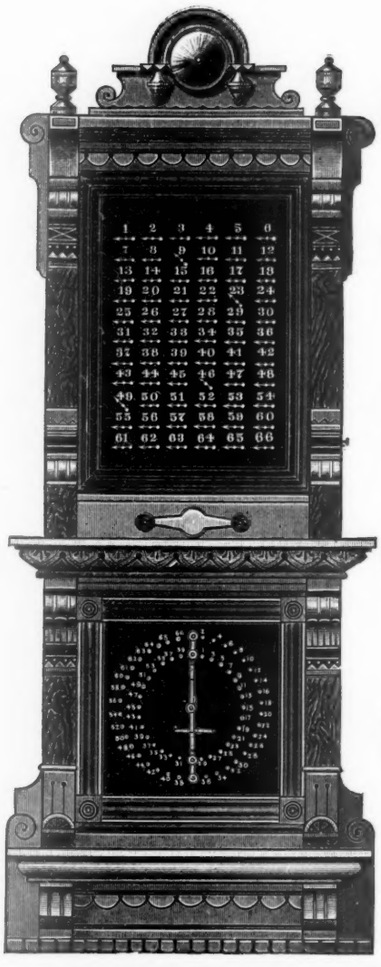
408, 410, 412 and 414 N. J. R.R. Ave., NEWARK, N. J.

Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased.

WESTERN ELECTRIC CO.'S

Electric Hotel Annunciators,

Hotel Fire Alarm and Room Call.



NO

Large Battery

IS REQUIRED

To Operate it and its

DAILY USE

AS A

Room Call

IS A CONSTANT TEST

OF ITS

Readiness for use in case of

FIRE.

Western Electric Co.

227 to 257 South Clinton St., CHICAGO;
70 to 76 Trinity Place, NEW YORK;
59 Moorgate Street, LONDON;
33 Rue Boudewyns, ANTWERP.

CHARLES L. BLY,

MANUFACTURER AND DEALER IN

ELECTRICAL SUPPLIES,

For the Telegraph, Telephone and Electric Light. Specialties: Electric Gas-Lighting Apparatus, Electric Bells and Annunciators, and Burglar Alarms.

37 Pearl St., Boston, Mass.

Brownlee & Co.,

DETROIT, MICH.

DEALERS IN

Cedar Telegraph Poles

MANUFACTURERS OF

Cross Arms, Pins and Brackets,

OAK AND LOCUST PINS,

BROWNLEE'S CONCAVED BRACKET.

Patent applied for.) Send for Catalogue.

The Connecticut District

TELEGRAPH & ELECTRIC CO.,

101 Bank Street, Waterbury, Conn.

ZINCS,

LECLANCHÉ ZINCS, with Thumb-screw or Patent Spring Connections, from Pure Spelter and well amalgamated.

GRAVITY BATTERY ZINCS AND COPPERS,

Medical Battery Zincs and Rolled Zinc Plates.

Burglar-Alarm Spring Batteries and Supplies.

WOOD & BRONZE PUSH-BUTTONS

Extra Fine Quality.

Special Agents for Bartholdi Two-Wire Automatic Gas Burner.

SEND FOR CATALOGUE AND PRICES.

TELEPHONE STOCKS

Of all the different Companies

BOUGHT AND SOLD ON COMMISSION,

ALSO

Chicago Local Stocks and Bonds.

S. G. LYNCH,

144 La Salle Street, Chicago.

ELECTRICAL NOVELTIES INTRODUCED!

Parties desiring to introduce new electrical appliances in Providence and vicinity should address:

PROVIDENCE ELECTRICAL SUPPLY CO.,

Manufacturers and Dealers in

ALL KINDS OF ELECTRICAL SUPPLIES,

59 South Main St., PROVIDENCE, R. I.

ELECTRIC BELLS A SPECIALTY.

PHOSPHOR-BRONZE

TELEPHONE WIRE,

Insulated and Bare.

"Phosphor-Bronze."

Combines High Electrical Conductivity and Resistance to Corrosion with Lightness and Tenacity.

Standard Sizes, 16, 17, and 18, stubs' Gauge.

ADDRESS:

The Phosphor-Bronze Smelting Co. (limited,)

512 ARCH ST., PHILADELPHIA, PA.

Owners of the United States Phosphor-Bronze Patents.

Sole Manufacturers of Phosphor-Bronze in the United States.

Eugene F. Phillips, President. W. H. Sawyer, Sec. & Electrician.

American Electrical Works

MANUFACTURERS OF

Patent Finished Insulated

ELECTRIC WIRES,

Telephone and Electric Cordage,

ELECTRIC LIGHT WIRE, MAGNET WIRE,

Patent Rubber-Covered Wire, Office and Annunciator Wire, Lead-Encased Wire, Anti-Induction, Aerial and Underground Cables, etc., etc.

FACTORY—PROVIDENCE, R. I.

New York Office—15 Cortlandt Street.

GEO. L. BEETLE, Agent.

FRANKLIN S. CARTER. CHAS. M. WILKINS. E. WARD WILKIN.

ESTABLISHED 1867.

PARTRICK & CARTER,

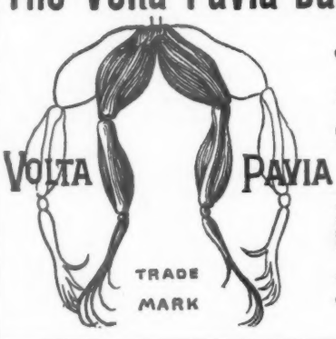
Manufacturers of and Dealers in every description of

ELECTRICAL SUPPLIES for the TELEGRAPH, TELEPHONE, ELECTRIC LIGHT, ETC.

Sole proprietors of the Patent Needle Annunciator. Annunciators, Burglar Alarms, Electric Bells, Batteries, Wire, etc. Illustrated catalogues and price lists sent free.

No. 114 SOUTH SECOND STREET, - - PHILADELPHIA, PA.

The Volta Pavia Battery and Solutions



Are now ready for Electric Lighting and other purposes.

Ten Cells will Maintain Two Eight-Candle Power Incandescent Lamps for

250 to 300 HOURS

On one Volta Pavia Solution.

The Chemical Electric Light and Power Co.

Have taken quarters at

109 COURT STREET,

where Incandescent Lamps, motors, fans, sewing machines, etc., run by Primary Batteries, can be seen at all times. Prices on Solutions are now Reduced. Send for new circulars to

WESTERN ELECTRIC CO., New York,

THE ELECTRICAL SUPPLY CO., Chicago, or

CHEMICAL ELECTRIC LIGHT & POWER CO.,

95 Milk St., Boston, Mass.

HARD RUBBER.

For all Electrical Purposes. In Sheets, Rods, Tubes, and special designs as ordered when practicable. Rubber Hook Insulators, Window Tubes with Heads, Key Knobs, Switch Handles, Plug Handles, Battery Cells, Battery Syringes, Electric Lamp Switch Handles, &c., &c. Manufactured by

THE BUTLER HARD RUBBER COMPANY,

38 MERCER STREET, NEW YORK.

Shultz Belting Company,

MANUFACTURERS OF

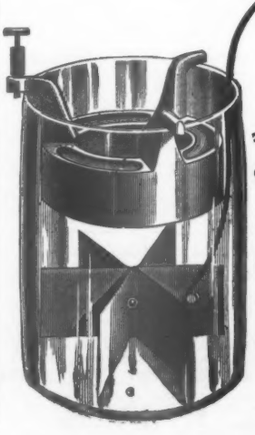
SHULTZ PATENT FULLED LEATHER BELTING AND LACE LEATHER.

Office and Factory: Cor. Bismarck and Barton Sts., St. Louis, Mo.

Our Belting is made of leather tanned on the surface only; the interior (which is the fiber and strength of the hide) is not tanned, but rawhide fulled and softened by our patented process. Our Belting is more pliable, hugs the pulley better, transmits more power than any other, and is the only perfect ELECTRIC LIGHT BELT MADE. Agents in all cities. Send for trial belt.

THE MORRISON

Gravity Battery



THE ONLY RELIABLE CLOSED-CIRCUIT BATTERY IN EXISTENCE.

After thirty years' experimenting with other batteries, The Gamewell Fire Alarm Telegraph Co. adopted it as their standard.

OFFICE OF THE GAMEWELL FIRE ALARM TELEGRAPH CO.,
1½ BARCLAY ST., NEW YORK CITY.
NEW YORK, August 14th, 1885.

THE SOUTHERN ELECTRIC CO., BALTIMORE, MD.

Gentlemen:—We have adopted the "MORRISON GRAVITY BATTERY" as the Standard Fire Alarm Battery for this company's service. After thirty years' experience we unhesitatingly endorse it as the best form of Gravity Battery ever devised.

Yours very truly, J. N. GAMEWELL,
General Superintendent Gamewell Police & Fire Alarm Telegraph Co.

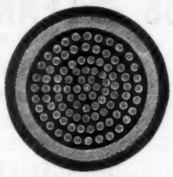
Manufactured only by

THE SOUTHERN ELECTRIC CO.,

Warerooms, Hoen Building, cor. North and Lexington Sts.; Works, cor. Constitution and Monument Sts.,

BALTIMORE, MD.

EUGENE F. PHILLIPS, President. W. H. SAWYER, Secretary and Electrician.



100 CONDUCTOR Telephone Cable.

AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

Exclusive Manufacturers of the

20 CONDUCTOR Telegraph Cable

FARADAY CABLE

FOR

Telegraph, Telephone and Electric Light.

HIGHEST INSULATION AND LOWEST INDUCTIVE CAPACITY

of Any Cable in the Market.

ELECTRIC LIGHT CABLE

New York Office, No. 15 Cortlandt Street.

GEO. L. BEETLE, Agent.

The Brevoort Mfg. Co.,

MANUFACTURERS OF

THE ROBERTS PERMANGANATE BATTERY.

This is the Best and the Cheapest Open-Circuit Battery in the market. It is far superior to any of the Sal-Ammoniac Cells Now in use.

Electromotive Force, 1.8 Volt; Amperes, 2.5

When the battery is exhausted all that is necessary is to supply a new solution; the battery is then as good as new. The zincs will last through two rechargings of the battery. Each Cell, with a single charge of solution, will outlast and outwork any sal-ammoniac battery.

PRICE, COMPLETE, - - $1.00.

Liberal Discount to the trade. Send for Price List and Descriptive Circular. Address office,

206 Broadway New York.

FOR SALE ALSO AT

E. S. GREELEY & CO., 5 and 7 Dey Street.
THE UNITED STATES ELECTRIC CO., 41 Wall Street, New York.
THE ELECTRIC GAS LIGHTING CO., 45 Milk Street, Boston.
C. E. JONES & BRO., 51 West 14th Street, Cincinnati, O.
ELECTRICAL SUPPLY CO., 17 Dey Street, New York.

UNION ELECTRIC CO.
1 Ann St., New York.
ELECTRIC SCARF PIN
with battery complete.
$2.00.—Weight, 6 oz.—C. O. D.

STANDARD ELECTRICAL INSTRUMENTS.
Galvanometers, Resistance Coils, Condensers, Keys, Switches, &c., Bailey Combination Set, Pratt's Speed Indicator, &c.
ELECTRIC MFG. CO, P. O. Box 80, Troy, N. Y.

DIRECT READING
AM-METERS, VOLT-METERS, VOLT-AM-METERS AND MILL-AM-METERS,
(A. K. EATON'S PATENT)
ALSO
Electrical Instruments of all kinds.
Manufactured and for sale by
A. K. EATON,
63 and 65 HENRY STREET,
Brooklyn, New York.

CASTINGS
FOR
SMALL DYNAMO,
For experimental purposes, also
Materials of all kinds
GOODNOW & WIGHTMAN,
176 WASHINGTON ST., BOSTON, MASS.

MODEL and EXPERIMENTAL WORK A SPECIALTY.
Send for Circulars.
C. E. Jones & Bro.
CINCINNATI, O.
(Mention this Paper.)

ALFRED F. MOORE,
Manufacturer of
Insulated Wire,
for Telephone, Telegraph and Electric Light.
OFFICE, LINE, AND
Annunciator Wire,
Magnet Wire, and Flexible Cordage,
200 & 202 N. THIRD ST.
PHILADELPHIA, PA.

THE ELECTRICAL SUPPLY CO.,

LICENSED AGENTS FOR THE SALE OF

Electric Gas Lighting Apparatus,

UNDER PATENTS CONTROLLED BY

A. L. BOGART,

INCLUDING THE BARTHOLDI AUTOMATIC BURNER.

The Smallest, Neatest and Most Perfect Automatic Burner Manufactured in the world.

THE ELECTRICAL SUPPLY CO.,

FACTORY, ANSONIA, CONN. 171 Randolph Street, Chicago. 17 Dey Street, New York.

THE SECURITY

Mutual Benefit Society

No. 233 Broadway, New York,

(Opposite Post Office.)

ONLY TWELVE ASSESSMENTS

Have been levied since the Society began business, averaging three a year, and making the cost for assessments to a man of 35 years, but $3.03 a year or each $1,000 of insurance.

Send for Circulars. Agents Wanted.

☞ Remunerative employment offered energetic and reliable men in all sections of the United States.

MITCHELL, VANCE & CO.,

GAS FIXTURE MANUFACTURERS,

Have added a department for the Manufacture of Electroliers and other fixtures adaptable to any system of Incandescent Electric Lighting, also Combination Fixtures for both Gas and Electric Light. Estimates and designs furnished upon application.

836 & 838 BROADWAY,
NEW YORK.

ELECTRICAL SPECIALTIES.

BROWN The Earth Open Circuit Battery.
The Alarm Electric Mat. **and** Electric Bells.
Zylonite Push Buttons. **BROWN,**

106 and 108 Liberty St., New York.

Schuyler Electric Light Co.,

Manufacturers of

DYNAMO MACHINES FOR INCANDESCENT AND ARC.

The most perfect system of both Incandescent and Arc Lighting. Entire freedom from hissing and flickering in our Arc Lights, and long life and great brilliancy in our Incandescent Lights.

Dynamo Machines with perfect automatic regulation, reliable and efficient.

Prices moderate. Estimates made for lighting from Central Stations or for isolated plants. Illustrated Circulars sent upon application. Address

New York Office: 44 BROADWAY

SCHUYLER ELECTRIC LIGHT CO.,
Hartford, Conn.

THE IDE ENGINE,

THE MOST SIMPLE DURABLE AND ECONOMICAL

Automatic Cut-Off Engine

In the World. References furnished from the most successful ELECTRIC LIGHT PLANTS in the Unite States. MEDAL AND HIGHEST AWARD from FRANKLIN INSTITUTE OF PHILA. Mfd. by

FOUNDRY AND MACHINE DEPARTMENT,
Harrisburgh Car Mfg. Co., HARRISBURGH, PA.

JARVIS ENGINEERING CO.,

BOSTON, MASSACHUSETTS.

CONTRACTORS FOR

Complete Steam Outfits for Electric Lighting Stations, Steel Boilers with Jarvis Furnaces to burn cheap fuels, Armington & Sims Engines, Etc.

SEND FOR CIRCULARS.

"OTTO" GAS ENGINE

OVER 10,000 IN USE.

Started Instantly by a Match, When Stopped all Expense Ceases.

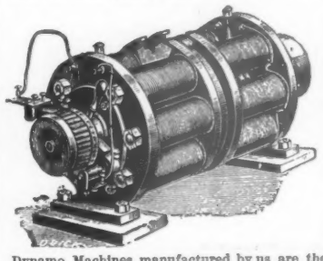
Works without boiler, steam, coal, ashes or attendance. Successfully adapted instead of steam power in all industries and offers special advantages for running electrical machinery for Telegraph and Telephone as well as Lighting purposes.

Built in Sizes of 1, 2, 4, 7, 10, 15 & 25 ind. H. P.

SCHLEICHER, SCHUMM & CO.
N. E. cor. 33d & Walnut, Phila.
Branch Office: 214 Randolph Street, Chicago.

THE WARREN P. FREEMAN CO.

ELECTRICAL SUPPLIES,
106 & 108 LIBERTY ST., N. Y.



Dynamo Machines manufactured by us are the most reliable, and require less attention than any in the market.

Our Incandescent and Arc Lights are taking the lead throughout this country, and all work guaranteed satisfactory.

Lowest Prices
FOR
BELLS,

E. W. HAZAZER,
32 Frankford Street,
NEW YORK.

PHILLIP REIS

INVENTOR OF
THE TELEPHONE.

A biographical sketch, with documentary testimony, translations of the original papers of the inventor and contemporary publications.
By Silvanus P. Thompson, B. A., D. Sc.
8vo, Cloth, Price $3.00, Post Paid.
E. & F. N. SPON, 35 Murray Street., N.Y.

MAGNETO SIGNAL BELLS.

No Battery Required.

"STANDARD."

$4, $6, and upwards, according to style desired. Discount on large lots.

We make a specialty of the manufacture of these bells for Telephone Companies, and after an experience of many years, our facilities for the prompt execution of large orders are unequaled.

Close attention given to furnishing samples for special orders.

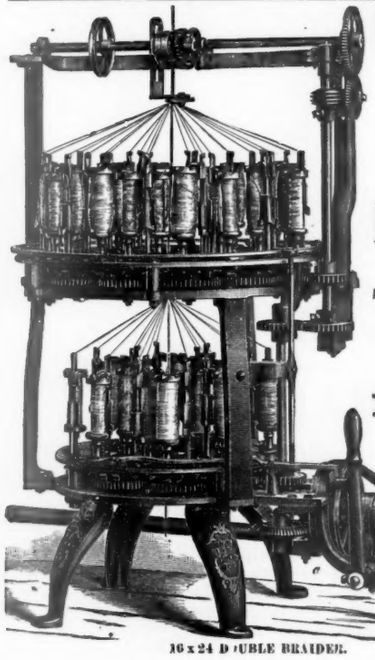
VIADUCT MANUFACTURING CO.
OF BALTIMORE.

A. G. DAVIS, President. A. B. PROAL, Secy. & Treas.
Office, North-West Corner Charles and German Streets,

ELECTRICAL GOODS OF EVERY DESCRIPTION.

Telephone, Telegraph, Electric Light, Fire Alarm and District Telegraph Supplies.

SEND FOR ILLUSTRATED CATALOGUE.



16 x 24 DOUBLE BRAIDER.

NEW ENGLAND BUTT CO.,

Providence, R. I.,

MANUFACTURERS OF

BRAIDING MACHINERY

FOR COVERING

Telegraph, Telephone

AND

ELECTRIC-LIGHT WIRE.

ALSO

SINGLE AND DOUBLE

WINDERS AND BRAIDERS

Of every Description for Silk, Worsted and Cotton Braid.

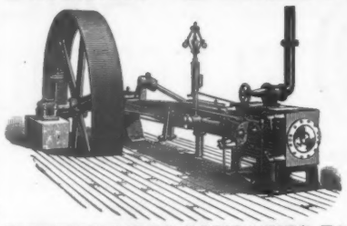
FINE CASTINGS A SPECIALTY.

HARRIS-CORLISS STEAM ENGINE

BUILT BY

WILLIAM A. HARRIS,

PROVIDENCE, R. I.



From 10 to 2000 Horse Power, with Harris's Improvements. These Engines are of

UNEXCELLED WORKMANSHIP,

and are known the world over as the

MOST ECONOMICAL STEAM ENGINE BUILT.

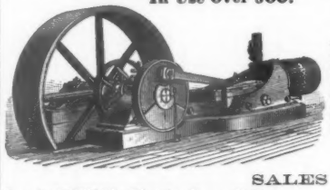
ELECTRIC LIGHT COMPANIES TAKE NOTICE! They are especially adapted for all purposes where continuous service at uniform speed is required and at the minimum of cost of repairs.

Send for a copy of Engineers' and Steam Users' Manual by J. W. Hill, M. E. Price, $1.25

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use Over 800.

25 to 1,000 H. P.

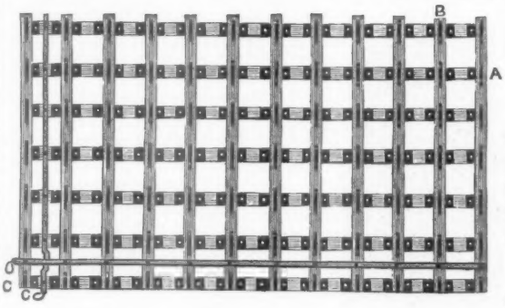


These Engines are the combined result of long experience with automatic cut-off regulation and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-Contained Automatic Cut-off Engines. 12 to 100 H.P. for driving Dynamo Machines a SPECIALTY.—Illustrated Circulars with various data as to practical Steam Engine Construction and performance, free by mail. Address

BUCKEYE ENGINE CO., Salem, O.

SALES AGENTS:

Geo. A. BARNARD, 70 Astor House, N. Y., and 53 Mason Building, Boston, Mass.
D. L. DAVIS, 84 S. Canal St., Chicago, Ill. and ROBINSON & CAREY, St. Paul, Minn.



THE ALARM

ELECTRIC MAT.

DESCRIPTION.

The brass strips *A* cross the brass strips *B* and are insulated at the intersections. Connection is made at *C* with bell and battery. The slightest pressure completes the circuit.

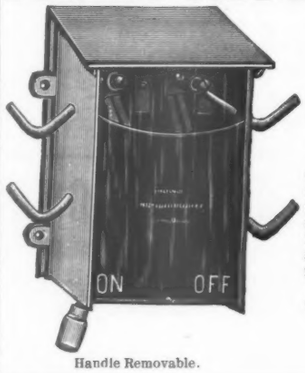
Send for Price-List and Circular. Agts. wanted.

BROWN & BROWN,
106 & 108 Liberty St. N. Y

FOREST CITY ELECTRIC WORKS,

SOLE MANUFACTURERS OF

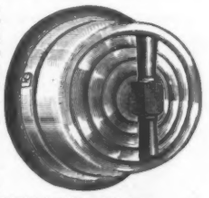
CLEVELAND'S ELECTRIC LIGHT CUT-OUTS,
GANG SWITCHES,
AND OTHER ELECTRIC LIGHT SUPPLIES,



Handle Removable.

In stock and to order.

Contracts made for special manufacture and for the exclusive use or sale of any Electrical apparatus. (Electric Light a specialty). Descriptions and prices on request.



Correspondence Solicited.

W. B. CLEVELAND, Prop.
26 S. WATER ST., CLEVELAND, O

TABLE OF
CONDUCTIVITY AND ABSORPTION
OF E. M. F. COPPER WIRE.
Invaluable to all Electricians and persons engaged in Electric Lighting. The only table published. Sent on receipt of 25 cts.
C. E. JONES & BRO., CINCINNATI, O.

MODEL and EXPERIMENTAL WORK A SPECIALTY.

Send for Circulars.
C. E. Jones & Bro.
CINCINNATI, O.
(Mention this Paper.)

Household Electric Light Company,

153 ESSEX STREET, BOSTON,

Have the only complete system of Electric Lighting for Private Dwellings, Offices, Stores, &c.

Dynamos to order for any special purpose. Electric Motors and Batteries.

MODEL AND EXPERIMENTAL WORK A SPECIALTY.

Send for Circular.

ELECTRIC LIGHT.

HENRY G. REES,

28 and 25 South 4th St., Philadelphia, Pa.

Undertakes the furnishing and erection of

Electric Light Plants of Every System.

Incandescent Wiring and Repairs to Dynamos and Lamps a Specialty. Estimates furnished on application.

SHEPARD'S $60. CELEBRATED
Screw-Cutting Foot Lathe.
GAP LATHE, $125.

Foot and Power Lathes, Drill Presses, Scrolls, Saw Attachments, Chucks, Mandreis, Twist Drills, Dogs, Calipers, &c. Send for catalogue of outfits for amateurs or artisans. Address,

H. I. SHEPARD, Agt,
134 E. SECOND STREET, CINCINNATI, O.

NEW ENGLAND GLASS WORKS,

29 MURRAY ST., NEW YORK. 155 FRANKLIN ST., BOSTON.

10 In.—Roughed all over.

10 In.—Opal.

9 In.—½ Horizontal Roughed.

12 In.—½ Vertical Roughed.

14 In—Clear Flint.

WE MAKE A SPECIALTY

OF

ELECTRIC GLOBES,

OF ALL SHAPES, IN

Clear, Roughed, or Opal Glass.

Our Facilities Enable us to Offer Special Inducements in

QUALITY AND PRICE.

W. L. LIBBEY & SON,

BOSTON, MASS.

SEND FOR PRICES.

VICTOR
Turbine Water Wheel.

The attention of **Electric Companies** is called to this **celebrated water wheel** as particularly adapted to their use, on account of its **remarkably steady motion, high speed** and **great efficiency,** and **large capacity** for its **diameter,** being **double** the **power** of most **wheels** of **same diameter.** It is used by a number of the leading electric companies with great satisfaction. In the economical use of water it is without an equal, producing the highest per cent. of useful effect, **guaranteed.**

SEND FOR CATALOGUE AND PARTICULARS.

STILWELL & BIERCE MFG. CO.,

DAYTON, OHIO.

(Please Mention this Paper.)

AUTOMATIC CUT-OFF ENGINE

Embodying a New System of Regulation.

THE GOVERNOR WEIGHS THE LOAD.

Send for Circular F

BALL ENGINE CO.,

ERIE, PA.

General Sales Agents

S. L. HOLT & CO.
67 Sudbury St. Boston, Mass.

KINGSLAND BROS. & CO.,
28 S. Canal St., Chicago, Ill.
923 N. 2d St., St. Louis, Mo.

TATUM & BOWEN,
Portland, Oregon. San Francisco, Cal.

BROOK, HORNER & CO., Baltimore, Md.
H. M. SEIPLE, cor. Arch and 3d Sts., Phila.

WE CHALLENGE THE WORLD on good regulation. Only Engine which ABSOLUTELY HOLDS to constant speed under all changes of load. An indispensable Feature for *ELECTRICAL LIGHTING.*

V. L. RICE, 66 Kasota Block, Minneapolis, Minn.
SHERIFF & ASHWORTH, Pittsburgh.

THE NATIONAL
TIME REGULATING COM'Y
BOSTON, - MASS.

Is now prepared to contract with

Telephone Companies

In the United States for the use of its Instruments for sending

Accurate Time Signals by Telephone

Every minute of the day or night.

By ONE INSTRUMENT in an exchange any number of subscribers in that exchange can be furnished with **Accurate Time** at a *nominal price* per year.

No change in subscribers' instruments required. Does not interfere with conversation. The subscriber simply listens at the receiver, without calling, and the signals are plainly audible.

For full particulars, please address,

JOHN M. ORAM,
GENERAL MANAGER,
P. O. Box 1351, BOSTON, MASS.

WHITE
Oak Pins and Brackets
OF OUR OWN MANUFACTURE.

TELEPHONE SWITCHBOARDS,
ELECTRIC BELLS,
MEDICAL BATTERIES,
AND A FULL SUPPLY OF
Covered Wires and Electric Sundries
ALWAYS ON HAND.

Send for Catalogue.

DETROIT ELECTRICAL WORKS,

Cor. 7th and Woodbridge Streets,
DETROIT, MICH.

ELECTRICAL REVIEW
Clubbing List for 1886.

Electrician and Electrical Engineer	$2.50
Manufacturers' Gazette	2.25
American Machinist	2.25
Scientific American	2.60
" " Supplement	4.00
" " and "	5.65

These rates are exclusively for subscribers for the ELECTRICAL REVIEW.

Any publication not on this list, let us know what is wanted, and it shall be furnished at lowest price.

Address

ELECTRICAL REVIEW,
Box 3329, New York.

H. M. RAYNOR,

No. 25 BOND ST., NEW YORK.
Established 1859.

PLATINUM IN All Forms FOR ALL PURPOSES,
WHOLESALE AND RETAIL.

CONNOLLY BROS.,

Patent Attorneys and Solicitors,
PITTSBURGH, PA.;
PHILADELPHIA, PA.,
Mutual Life Ins. Building, 10th and Chestnut Sts
WASHINGTON, D. C.,
CORNER 6th AND F STREETS.
ELECTRICAL CASES A SPECIALTY.

DORSETT'S UNDERGROUND CONDUIT SYSTEM.

Electrical Insulator, Water, Gas and Sewage Proof! Absorbs no Moisture! Frost Cannot Affect It!

CRUSHING STRAIN, 5,500 LBS. PER SQUARE INCH—GOVERNMENT TEST.

A Complete, Comprehensive System of Conduits for Electric Light, Telegraph, Telephone and Private Wires and Cables for Rental Purposes.

The 2¼-inch ducts in this Conduit are leased to different companies, which may then occupy them with such wires and cables as they may adopt. New wires may be introduced or old ones replaced through these ducts between the man-holes as shown in the cut.

An experience of six years for Underground Drainage has shown the superiority of this material as a resistant of moisture, and its consequent immunity from damage by frost. It has been in use for electrical purposes the past winter in the solidly frozen streets of Chicago without injury; is the system used by that city, giving perfect, unbounded satisfaction, and is now being introduced into the cities of St. Louis, Cincinnati and Detroit. The whole body of the Conduit is a thoroughly reliable insulator, unaffected alike by acids and alkalies. The cheapest and most perfect Conduit in the market to-day.

☞ CORRESPONDENCE SOLICITED. ☜

D. H. DORSETT, Proprietor, No. 61 La Salle Street, Chicago, Ill.

SCHAEFER ELECTRIC MFG. CO.

INCANDESCENT LAMPS, From 10 to 100 Candle Power. DYNAMO MACHINES of Improved Construction.

Proposals and Estimates furnished for Complete Installations of Incandescent plants upon application to

P. O. Box, 3068, Boston, Mass.

FACTORY AT CAMBRIDGEPORT, MASS.

J. H. BUNNELL & CO.

106 and 108 Liberty St., NEW YORK.

TELEGRAPH INSTRUMENTS,

Wire, Insulators, Batteries, Bells and Electrical Supplies.

The Largest Stock and Best Variety of Main Line and Short Line Instruments in any American Establishment.

SEND FOR LATEST ILLUSTRATED CATALOGUE, FREE, ALSO TELEGRAPHIC MANUAL, FREE, TO ANY ADDRESS.

REMINGTON

Standard Type-Writer.

Ask for Particulars Regarding the Use of the Remington Type-Writer in Receiving Messages.

WYCKOFF, SEAMANS & BENEDICT, 339 Broadway, New York.

PAINE & LADD,

HALBERT E. PAINE, Late Commissioner of Patents. | STORY B. LADD.

Attorneys in Patent Causes And Solicitors of Patents.

WASHINGTON, D. C.

THE CURT BATTERY.

Actually the cleanest, most durable and practical, therefore the cost economical and effective cell in the market. For experimenting, for medical purposes, for the laboratory, no more suitable cell could be found.

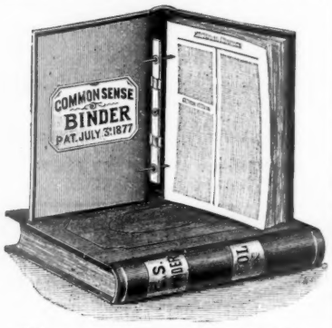
ADDRESS FOR CIRCULARS.

CURT W. MEYER, 357 Fourth Ave. New York.

BINDERS

FOR THE

ELECTRICAL REVIEW.



We are now prepared to furnish for the convenience of subscribers to the

REVIEW,

Or for any other Electrical or Scientific journal published in this country,

one of the latest improved self-binders. The binders are of the exact size of the paper, and each issue, as received, can be filed in it without trouble. When the volume is complete at the end of the year, it can be permanently fastened in a moment, making in appearance a volume almost as durable as one specially bound. The binder will be sent, postage prepaid, to any part of the United States, on receipt of $1.00. Address,

ELECTRICAL REVIEW,

P. O. Box 3329. 23 Park Row, New York.

"THE ELECTRICAL REVIEW," An illustrated weekly journal, is the acknowledged leader in the world of electrical science. Edited with care. Its editorial opinion is reliable, its news columns bright and instructive. $3.00 per year; single copies, 10 cents. 23 PARK ROW, NEW YORK. Best advertising medium in the electrical field.

TABLE OF

CONDUCTIVITY AND ABSORPTION

OF E. M. F. OF COPPER WIRE.

Invaluable to all Electricians and persons engaged in Electric Lighting. The only table published. Sent on receipt of 25 cts.

C. E. JONES & BRO., CINCINNATI, O.

ALBERT L. RUSSELL,

Manufacturer of and Dealer in

TELEGRAPH & ELECTRICAL INSTRUMENTS

House and Hotel Annunciators, Line and Office Wire, Fine Instruments for Electric Testing, etc., at the old stand of

CHARLES WILLIAMS, Jr.,

109 & 115 COURT ST., BOSTON, MASS.

Executive Committee Meeting.

A Meeting of the Executive Committee of the NATIONAL ELECTRIC LIGHT ASSOCIATION will be held at the HOTEL DAM, NEW YORK CITY, on TUESDAY MAY 11th.

This is an important Meeting and all Members should be present.

A. J. DE CAMP,

Chairman Executive Committee.

FOR SALE.

One Brush Arc Light Dynamo, Capacity, 3-2000 C.-P. Lamps.

One Brush Incandescent Dynamo, Capacity, 50-16 C.-P. Lamps.

WILL BE SOLD CHEAP FOR CASH.

THE ALLEGHENY COUNTY LIGHT CO., Pittsburgh, Pa.

UNION SQUARE HOTEL,

AND HOTEL DAM,

HEADQUARTERS:

Telephone, Telegraph and Electric Light People.

A. J. DAM & SON, Proprietors,

Union Square, cor. 15th Street, New York.

American and Foreign Books

—ON—

ELECTRICITY

and Its Applications.

An Excellent Opportunity to buy ELECTRICAL, SCIENTIFIC and Other TEXT BOOKS

Electrical Review Publishing Co.

Abernethy's Commercial and Railway Telegraphy	15	Cloth.	$2 00
Alternating Currents of Electricity. By Thomas H. Blakesley, M. A. Cloth, 90 pages, 11 illustrations			60
Anderson's Lightning Conductors	30	Cloth.	6 50
Bond's Handbook of the Telegraph	17	Cloth.	1 25
Cavendish's Electrical Researches	10	Cloth.	5 00
Clark & Sabine's Electrical Tables and Formulæ	20	Cloth.	5 00
Cook's Magnetism and Electricity	9	Cloth.	40
Culley's Handbook of Practical Telegraphy	18	Cloth.	6 00
Cumming's Theory of Electricity	11	Cloth.	3 00
Davies & Ray's Electrical Diagrams and Connections	16	Cloth.	2 00
Dolbear's Telephone	21	Cloth.	50
Domestic Electricity. A book principally for amateurs. Translated from the French of E. Hospitalier by C. J. Wharton. Cloth, 229 pages, 155 illustrations.			3 00
Douglas' Telegraph Construction	20	Cloth.	6 00
Dredge's Electric illuminations, Vol. II	25	Cloth.	7 50
Du Moncel's Telephone, Microphone and Phonograph	22	Cloth.	1 25
Du Moncel's Electricity as a Motive Power	27	Cloth.	3 00
Du Moncel's Electric Lighting	23	Cloth.	1 25
Du Moncel's Electro Magnets. *American Edition*	14	Boards.	50
Du Moncel's Electro Magnets. *English Edition*	14	Cloth.	75
Dyer's Induction Coils	13	Boards.	50
Dynamic Electricity	26	Boards.	50
Dynamo-Electric Machinery (New Edition, Enlarged and Revised). A manual for students of electrotechnics. By Silvanus P. Thompson. Cloth, 8vo, 527 pages, 324 illustrations			5 00
Electric Railways and the Electric Transmission of Power. Described in plain terms by Robert Luce, A. M. Cloth, 106 pages, illustrated, $1; paper			50
Electro-Chemistry, Inorganic. By G. Gore, F.R.S., LL.D, etc. Cloth, 138 pages.			80
Electro-Deposition. A Practical Treatise on the Electrolysis of Gold, Silver, Copper, Nickel and other Metals and Alloys, with descriptions of Voltaic Batteries, Magneto and Dynamo-Electric Machines, Thermoplies, and of the Materials and Processes used in Every Department of the Art, and several chapters on Electro-Metallurgy. By Alexander Watt. Cloth, 528 pages, 144 illustrations			5 00
Electrolysis. A Practical Treatise on Nickeling, Coppering, Gilding, Silvering, the Refining of Metals and Treatment of Ores by means of Electricity. By Hippolyte Fontaine. Translated from the French by J. A. Berley. Cloth, 264 pages, 34 illustrations			3 50
Faraday's Researches in Electricity. 3 vols	10	Cloth.	20 00
Ferguson's Electricity. *New Edition*	6	Cloth.	1 50
Fiske's Electricity and Electrical Engineering	9	Cloth.	2 50
Gordon's Electricity and Magnetism. 2 vols	10	Cloth.	10 00
Gordon's Lectures on Induction	13	Cloth.	80
Gray's Absolute Measurements in Electricity and Magnetism	—	Cloth.	1 00
Hammond's Electric Light in Our Homes	—	Cloth.	1 25
Harris' Rudimentary Electricity	5	Boards.	50
Harris' Rudimentary Galvanism	6	Boards.	50
Harris' Rudimentary Magnetism	6	Boards	1 80
Haskin's Galvanometer	14	Mo'roc.	1 50
Hedge's Useful Information on Electric Lighting	24	Cloth.	1 75
Hoskiær's Laying and Repairing of Cables	19	Cloth.	1 50
Hoskiær's Guide for Testing Telegraph Cables	19	Cloth.	1 50
Hospitalier's Modern Application of Electricity. 2 vols	27	Cloth.	8 00
Incandescent Electric Lights	24	Boards.	50
Jenkin's Electricity and Magnetism	9	Cloth.	1 50
Lardner's Natural Philosophy, Electricity, Magnetism and Acoustics	7	Cloth.	2 00
Levander's Solutions of Questions in Magnetism and Electricity	6	Cloth.	1 00
Lockwood's Electrical Measurement and the Galvanometer	14	Cloth.	1 50
Lockwood's Practical Information for Telephonists	21	Cloth.	1 00
Lockwood's Electricity, Magnetism and Electro-Telegraphy	18	Cloth.	2 50
Loring's Handbook of the Telegraph. Boards, 50c., cloth, 75c	15	Mo'roc.	1 00
Manual of Telegraphy. By W. Williams. Cloth, 327 pages, 90 illustrations			4 20
Mascart & Joubert's Electricity and Magnetism	12	Cloth.	7 50
Maxwell's Electricity and Magnetism. 2 vols	12	Cloth.	8 00
Maxwell's Elementary Treatise on Electricity	11	Cloth.	2 00
McGregor's Questions on Electricity and Magnetism	—	Flexible.	60
Munro's Electricity and its Uses	—	Cloth.	1 40
Murdock's Notes on Electricity and Magnetism	11	Cloth.	60
Napier's Manual of Electro-Metallurgy	29	Cloth.	3 00
Niaudet's Electric Batteries	13	Cloth.	2 50
Noad's Student Textbook of Electricity	8	Cloth.	4 00
Parnell's Action of Lightning	—	Cloth.	3 00
Pope's Modern Practice of the Electric Telegraph	15	Cloth.	1 50
Preece & Sivewright's Telegraphy	18	Cloth.	1 50
Prescott's Electricity and the Electric Telegraph	19	Cloth.	5 00
Prescott's Bell Telephone	—	Cloth.	4 00
Prescott's Dynamo Electricity	—	Cloth.	5 00
Reports of Committee on Electrical Standards	14	Cloth.	3 75
Sabine's History and Progress of the Electric Telegraph	17	Cloth.	1 25
Sawyer's Electric Lighting by Incandescence	24	Cloth.	2 50
Schellen's Dynamo-Electric Machinery	—	Cloth.	5 00
School Electricity. By J. E. H. Gordon, B. A. Camb. Cloth, 262 pp, 139 illustrations			2 00
Schwendler's Testing. 2 vols	20	Cloth.	8 00
Shoolbred's Electric Lighting	23	Cloth.	2 00
Smith's Manual of Telegraphy	15	Paper.	80
Spang's Lightning Protection	30	Cloth.	75
Sprague's Electricity in Theory and Practice	—	Cloth.	6 00
Swinton's Electric Lighting	—	Cloth.	1 50
Swift's Practical Telegraphy	16	Cloth.	1 50
Swinburne's Electrical Units Popularly Explained	—	Flexible.	60
The Mathematical Theory of Electricity and Magnetism. By H. W. Watson, D. Sc., F.R.S.; and S. H. Burbury, M.A. Cloth, 262 pages, 43 illustrations			2 75
Thompson's Elementary Lessons, Electricity and Magnetism	8	Cloth.	1 25
Thompson's Dynamo-Electric Machinery	26	Boards.	50
Thompson's Dynamo-Electric Machinery (complete)	—	Cloth.	5 00
Thunder and Lightning. By W. De Fonvielle. Cloth, 285 pp, numerous illustrat'ns			1 00
Tyndall's Lessons in Electricity	5	Cloth.	1 00
Tyndall's Light and Electricity	7	Cloth.	1 25
Urquhart's Electric Light	23	Cloth.	3 00
Urquhart's Electro-Plating	29	Cloth.	2 00
Urquhart's Electrotyping	29	Cloth.	2 00
Urquhart's Electro-Motors	27	Cloth.	3 00
Watt's Electro-Metallurgy	28	Cloth.	1 00
Wahl's Galvanoplastic Manipulations	30	Cloth.	7 00
Wonders of Acoustics; or, The Phenomena of Sound. From the French of Rodolphe Radau, with an additional chapter on the Reproduction and Transmission of Articulate Speech. Cloth, 288 pages, 116 illustrations			1 00
Woodbury's Protection and Construction of Mill Floors	25	Cloth.	2 50

Remit Postal Note or Order, Draft, Registered Letter, or Express to order of

ELECTRICAL REVIEW,

P. O. Box 3329. 23 Park Row, New York.

THE UNITED STATES ILLUMINATING CO.

59 AND 61 LIBERTY STREET, NEW YORK.

SOLE GRANTEES OF THE PATENTS OF WESTON, MAXIM, FARMER AND OTHERS FOR THE CITY OF NEW YORK AND VICINITY.

Five years' practical experience in the installation of these well-known systems of Arc and Incandescent Electric Lighting, enables the Company to give the most perfect, reliable and economical Electric Lighting known.

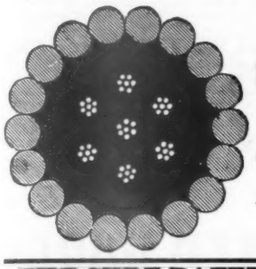
Among the most prominent installations which this Company has effected in the city and vicinity, are the following:

New York Post Office,
Washington Building,
Mortimer Building,
Union Ferry Co.,
Pennsylvania R. R. Ferry,
Mutual Life Insurance Co.,
Coleman House,
Hotel Dam,
St. Denis Hotel,
Bechtel's Brewery, Staten Island,
Brooklyn Eagle,
Opperman & Muller, Turtle Bay Brewery,
Equitable Building,
New York Ferry Co.,
Tribune Building,
Press Club,
Delmonico's,
Hotel Brunswick,
Lotus Club,
Union Club,
Union Square Hotel,
Brooklyn Bridge, and others

Estimates made by Experts at short notice, on application at the office of the Company.

THE BISHOP GUTTA-PERCHA CO.,

420 to 426 East 25th St., N. Y.,



Have improved machinery and increased facilities for making

Submarine, Subterranean and Aerial Cables.

We guarantee our productions

TO BE SUPERIOR TO ANY IMPORTED,

and to sell at prices which will render importation unnecessary. All the *GUTTA-PERCHA* insulated cables made in this country have been manufactured at our works.

All kinds of Insulated Wires at the Lowest Prices.

PURE GUTTA-PERCHA FOR ALL PURPOSES.

W. W. MARKS, Supt. HENRY A. REED, Sec'y.

THE CURT BATTERY.

Actually the cleanest, most durable and practical, thereby the most economical and effective cell in the market. For experimenting, for medical purposes, for the laboratory, no more suitable cell could be found.

ADDRESS FOR CIRCULARS.

CURT W. MEYER, 357 Fourth Ave. New York.

CARBONS

FOR ARC LIGHTING.

Only Manufacturers using Natural Gas, thus securing

Uniformity, Durability & Superior Light.

PITTSBURGH CARBON CO., lim'd,

PITTSBURGH, PA.

BOULTON CARBONS

These carbons are made of the

BEST MATERIALS,

and with the latest improved machinery, of **any required degree of hardness,** and can be used in all makes of Electric Lamps.

The regular sizes, 12 inches long, run from ¼ inch to 1 inch diameter, varying by sixteenths.

Special LENGTHS and SIZES to Order.

A large and complete stock always on hand.

The want of a high order of battery plate has long been felt. Those wishing such would do well to use the

BOULTON PLATES.

Special attention is given to the manufacture of all sizes to order.

Price Lists and full information furnished on application.

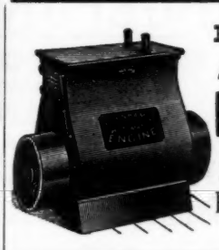
Also Exclusive Agents of the celebrated

AUSTRIAN Cored CARBON for the United States.

BOULTON CARBON WORKS,

Foot of Wilson Avenue,

CLEVELAND, OHIO.



BURNHAM SELF-OILING Automatic Steam

Engine

Patented Feb. 23, 1886.

Catalogue sent free by

Burnham Engine Co.

YORK, PA.

ROYCE & MAREAN,

DEALERS IN

ELECTRICAL APPARATUS

Telegraph and Telephone Supplies,

No. 1408 Penna. Avenue,

Opp. Willard's Hotel, WASHINGTON, D. C

STANDARD UNDERGROUND CABLE COM'Y,

MANUFACTURERS OF

The WARING ANTI-INDUCTION and BUNCHED

Telegraph, Telephone and Electric Light, Underground and Submarine

CABLES,

LEAD COVERED WIRE FOR INSIDE USE, PROOF AGAINST DAMPNESS.

No. 128 Pearl St., New York City. {All Work Guaranteed.} No. 88 Fourth Ave., Pittsburgh, Pa.

THE AMERICAN BELL TELEPHONE CO.

95 MILK STREET, BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

THOMAS S. HARRISON, President. KENTON WARNE, Secretary and Treasurer.
ALFRED F. MOORE, Vice-President and General Manager.

Directors: Thomas S. Harrison, Henry C. Gibson, David Brooks, W. F. Russell, Alfred F. Moore.

THE ELECTRICAL CONSTRUCTION AND MAINTENANCE CO.,

Manufacturers and Contractors for the

BROOKS

Underground, Overhead and Submarine Cables,

FOR TELEPHONE, TELEGRAPH AND ELECTRIC LIGHT PURPOSES,

Operating under patents of David Brooks' Oil System. D. Brooks, Jr., Anti-Induction Lead Armored Cables.

OFFICE: 200 AND 202 NORTH THIRD STREET - - PHILADELPHIA.

William Marshall,

Manufacturer of ELECTRICAL CONDENSERS. MAGNETS CHARGED, ETC.
Rooms 2 and 4 University Building,
Corner Waverley and University Places, New York.

MODEL and EXPERIMENTAL WORK A SPECIALTY.

Send for Circulars. C. E. Jones & Bro. CINCINNATI, O. (Mention this Paper.)

Consolidated Electric Light Co.,

Owning and Operating the

SAWYER-MAN PATENTS.

EXECUTIVE OFFICES:
Mutual Life Building,
NEW YORK.

PHILADELPHIA OFFICE
205 Walnut Street;
BOSTON OFFICE:
4 Pearl Street.

CHARLES H. BANES, President.
HUGH R. GARDEN Vice President.
HENRY C. DAVIS, Treas. and General Manager.

Plans and Estimates Furnished for all kinds of INCANDESCENT LIGHTING.

ESTIMATES FURNISHED for the Thomson-Houston System of Arc Lighting.

THE THOMSON-HOUSTON ELECTRIC CO.

PRINCIPAL OFFICE,

178 DEVONSHIRE STREET, BOSTON, MASS.,

Furnishes the only Perfect

Automatic, Self-Regulating System of Electric Arc-Lighting in the World

In all desirable qualities of ELECTRIC ARC-LIGHTS, the Thomson-Houston System has no equal. The Lights are *superior in color and steadiness,* and the entire apparatus is more *economical, efficient* and *safe,* more *easily managed,* and *less liable to derangement* than any other.

The Thomson-Houston Electric Company

was awarded the FIRST PRIZE for the *best system* of Arc-Lighting, and the *best Arc Lamp,* at the Cincinnati Industrial Exposition of 1883.

The Thomson-Houston System

has been awarded *superiority in all the competitive tests* to which it has been subjected.

New Illustrated Pamphlet will be sent on application.

THE

United States Electric Lighting Co.

SOLE MANUFACTURERS OF

WESTON

DYNAMO MACHINES

FOR BOTH

Arc and Incandescent Lighting and Electro plating.

WESTON ✝ ARC ✝ LAMPS,

Weston Incandescent Lamps,

ELECTRIC MOTORS, AUTOMATIC REGULATORS,

Fixtures, Fittings, &c.

THE WESTON SYSTEMS OF

Arc and Incandescent Lighting

ARE SUPERIOR TO ALL OTHERS IN

EFFICIENCY, SAFETY, RELIABILITY AND

Perfection of Automatic Regulation.

Full information with prices and estimates furnished upon application

General Office, 59 & 61 Liberty St., New York.

Chicago Office, 216 LA SALLE STREET.

CHARLES A. CHEEVER,
President.

OKONITE
TRADE MARK.

WILLARD L. CANDEE,
Treasurer.

THE OKONITE COMPANY,

MANUFACTURERS OF

Telephone, Telegraph and Electric Light Wires and Cables for Underground, Submarine and Aerial Use.

13 PARK ROW, - - - NEW YORK.

Thermostats and Thermostatic Fire-Alarm Apparatus.

Thermostat Two-thirds Actual Size.

OUR PATENT CLOSED-CIRCUIT SYSTEM IS ABSOLUTELY RELIABLE AND ECONOMICAL, AND DOES NOT GIVE A FALSE ALARM WHEN THE CIRCUIT IS BROKEN ACCIDENTALLY.

Our patent hydro carbon thermostat is ornamental, adjustable and never ailing, closing or opening the circuit with great force, and does not destroy itself by use. A sample thermostat mailed on receipt of one dollar.

Territorial rights and licences can now be negotiated.

SEND FOR CIRCULAR TO

The Martin-Wilson Automatic Fire Alarm Co., 53 State St., Boston, Mass.

38 Conductor Aerial Telephone Cable.

DAY'S Kerite Insulated WIRES AND CABLES

For Telephone, Telegraph and Electric Light Use and Electrical Circuits Generally.

The reliability and durability of Kerite Insulation is unsurpassed, as has been proven by years of experience. All rubber and gutta-percha compounds are very short-lived when placed either in the air or underground, and the supposed new insulating materials now being presented to the public, are most of them old and discarded experimental products. The present high standard and uniform quality of Kerite is the result of 30 years' experience.

The attention of TELEPHONE MANAGERS is especially asked to our ANTI-INDUCTION TELEPHONE CABLES, they being the most practical and durable in the market.

TELEGRAPH, TELEPHONE and ELECTRIC LIGHT Wires, for either SUBMARINE or UNDERGROUND work a specialty. Estimates for complete systems of underground wires and conduits will be furnished on application.

AUSTIN G. DAY, Sole Manufacturer.

CLARK B. HOTCHKISS, Gen'l Agent,

120 BROADWAY, NEW YORK.

THE BEST IS THE CHEAPEST.

The Brush-Swan Electric Light Co. of New England.

W. L. STRONG, President. GAYLORD McFALL, Secretary.
A. D. JUILLIARD, Vice-President. R. W. ABORN, Treasurer.
JOHN B. POWELL, General Manager.

REMOVED TO Nos. 204, 206, 208, 210 ELIZABETH ST., NEW YORK.

WHERE ELECTRICAL APPARATUS FOR ALL THE VARIOUS MODES OF LIGHTING AND TRANSMITTING OF POWER ARE IN OPERATION.

NO OTHER SYSTEM IS AS ECONOMICAL IN INSTALLATION AND MAINTENANCE.

NO OTHER ELECTRIC LIGHT APPARATUS IS AS DURABLE.—THE FIRST MACHINES MADE ARE STILL IN DAILY OPERATION.

THE SYSTEM COMPRISES:
- Arc Lights of various Sizes.
- Arc and Incandescent Lights from one Dynamo and Circuit.
- Incandescent Lights of various Sizes from Special Dynamo for Central Station Lighting.

Cost of Apparatus Greatly Reduced. Surveys and Estimates Furnished by Experts.

☞ **This company owns and controls all the Patents for ARC LIGHTING issued to CHAS. F. BRUSH, of Cleveland, for the New England States, New York, Pennsylvania, New Jersey, Delaware, Maryland, and the District of Columbia; also the Swan Patents for the same territory.**

G. W. STOCKLY, President. J. J. TRACY, Vice-Prest. W. F. SWIFT, Secretary.
J. POTTER, Treasurer. N. S. POSSONS, Supt. W. S. POSSONS, Asst. Supt.

THE BRUSH ELECTRIC CO.,

The Sole Manufacturers, under all the patents of Charles F. Brush, for Electric Lighting, Storage Batteries, Carbons, Electro-Plating Machines, Electric-Motors, &c.

WE FURNISH the ONLY COMPLETE and PERFECT SYSTEM OF ELECTRIC LIGHTING.

Machines for Arc Lighting, giving lights of 1,200, 2,000, 3,000, 4,000 and up to 100,000 candle power. Our No. 8 machine gives 65 lights of 2,000 c. p. with about 45 H. P.

Over twenty different styles of arc lamps, for indoor and outdoor use, and for tower lighting.

MACHINES FOR INCANDESCENT LIGHTING,

adapted for use with Swan Incandescent lamps. These machines are automatic and do not require the use of any switches or resistances outside of the machine to govern the current. Will run any number of lamps from one up to the full capacity of the machine, without change of speed and without the use of any apparatus outside of the machine.

Our prices are lower than other makers.

Storage Batteries, for Incandescent Lighting and for Electric Motors. Our storage batteries are the only practical ones offered in the market. They are especially adapted for situations where lights are needed for only four or five hours per day and where it is convenient to use power during the day to store up the current. There are thousands of such places where our storage battery must eventually be used.

CARBONS FOR ARC LAMPS.

Our carbons are the purest and best made. We have the largest and most fully equipped carbon factory in the world and our prices are very low.

ELECTRIC MOTORS.

We have commenced the manufacture of the Brush Electric Motors and shall soon be prepared to fill orders for all sizes from one up to forty horse-power. In many locations these are the most economical producers of power and will be largely used by Lighting Companies and others who need small powers are required.

THE BRUSH ELECTRIC CO., BELDEN ST., NEAR MASON. *Cleveland, O., U. S. A.*

ANSONIA BRASS & COPPER CO.,

Manufacturers of

Pure Electric Copper Wire,

BARE AND COVERED, OF EVERY DESCRIPTION.

"ACME" BRONZE TELEGRAPH AND TELEPHONE WIRE.

Warerooms: 19 & 21 Cliff St., New York. Factories: Ansonia, Conn.

Incandescent Lighting on Arc-Light Circuits.

The Brown Automatic Converter

Will supply and take care of ten to twelve 16 C. P. Incandescent Lamps, at any point on an arc-light circuit from an initial current equal to 5,000 C. P. arc lamp.

Can be used with any make of arc-light dynamo.

Any number of the lamps can be turned on or off without affecting the rest.

Invaluable to arc lighting companies as a means by which they can secure customers, from one up, for incandescent lighting anywhere on their circuit, without involving the large expense for incandescent lighting plants, or the necessity of getting a large number of subscribers to commence with. Address,

THE BROWN ELECTRIC CO.,
400 WOOD ST., PITTSBURGH, PA.

S. H. WILLARD, Vice-Pres., Treas. and Gen. Mgr.

ESTABLISHED 1853,

H. C. ADAMS, New York Agt.
P. C. ACKERMAN, Boston Agt.

HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

BARE AND INSULATED WIRES

—FOR—

ELECTRIC LIGHTS, TELEGRAPH AND TELEPHONE.

SOLE AGENTS FOR

"FOREST CITY" Carbons *For ELECTRIC LIGHTING.*

WAREROOMS, {25 Park Place, 22 Murray St.,} NEW YORK. {18 Federal St., 117 Congress St.,} BOSTON.

Factories, WATERBURY, CONN.

BRIDGEPORT BRASS CO.,

BRIDGEPORT, CONN.,

INCORPORATED 1865.

BRASS, COPPER AND GERMAN SILVER

WIRE AND ROLLING MILLS,

Bare and Insulated Copper Wire for Electric Conductors a specialty.

SOLE AGENTS FOR THE

BRIDGEPORT ELECTRIC MFG. CO.

THE ARMINGTON & SIMS

Automatic Cut-Off Engine,

FOR ALL PURPOSES WHERE POWER IS REQUIRED.

CLOSE REGULATION.
ECONOMICAL OF FUEL,
SMALL SPACE REQUIRED,
MODERATE PRICE.

OVER 1,700 ENGINES IN USE.

SELLING AGENTS:

JARVIS ENGINEERING CO., 61 Oliver St., Boston.
POND ENGINEERING CO., St. Louis, Mo.
J. F. RANDALL, Warren, Ohio
JOHN R. MARKLE, Detroit, Mich.
H. B. SMITH MACHINE CO., 925 Market St., Phil., Pa.
F. H. HAYWARD, 201 La Salle St., Chicago, Ill.
T. W. ANDERSON, New Orleans, La.
E. P. HAMPSON & CO., 86 Cortlandt St., New York.
TANNER & DELANEY ENGINE CO., Richmond, Va.
MORTON, REED & CO., Baltimore, Md.
WM. MINNIGERODE, Atlanta, Ga.
A. J. MILLER, Danville, Va.
W. R. BURGESS, Greensboro, N. C.
W. S. JOHNS, Pensacola, Fla.
S. S. PEGRAM, Macon, Ga.
J. A. HAUSER, Montgomery, Ala.

TABLE OF
CONDUCTIVITY AND ABSORPTION
OF E. M. F. OF COPPER WIRE.

Invaluable to all Electricians and persons engaged in Electric Lighting. The only table published. Sent on receipt of 25 cts.

C. E. JONES & BRO., CINCINNATI, O.

ELECTRIC LEATHER BELTING

MOST RELIABLE FOR DYNAMOS AND SWIFT-RUNNING MACHINERY.

Warranted to run steady and smooth, and without stretching. Write for particulars and prices to

CHARLES. A. SCHIEREN & CO.,

Manufacturers and Tanners of Oak Leather Belting and Lace Leather.

47 Ferry Street, New York.

16 ARCH ST., PHILADELPHIA. 86 FEDERAL ST., BOSTON

TRIPLEX INSULATED

Wire and Rubber Co.

SUPERIOR QUALITY OF INSULATION

ON ALL CLASSES OF

Electric Wires AND CABLES.

Address, 159 FRONT ST., New York City.